RAILROAD GAZETTE

FRIDAY, APRIL 24.

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Contributions.

Coupler Unlocking Devices.

TROY, N. Y., April 20, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The last paragraph of the contribution to your issue of April 17, 1891, entitled "Coupler Unlocking Devices," is liable to misconstruction. While agreeing generally, as every one must, with the statements made in the article that nearly all of the M. C. B. couplers in general use do not conform to the law, from the fact that the brakemen must go in between the cars to open the knuckle for coupling [See Laws of the State of New York 1886, Chap. 439, Sec. 4, which says that "unless the same (refering to coupler) can be coupled and uncoupled automatically without the necessity of having a person go between the ends of the cars," (to open the knuckle)]. It is not a fact that all devices of the M. C. B. type have this failing.

The Trojan Automatic Coupler, manufactured by us, is operated from the side by a rod, under the protection of the dead blocks; and it may be either brought up on the end of the car, or may be hung completely under the end sill. This rod connects directly with the lock of the coupler, which may be unlocked and the knuckle thrown open by its use. The coupler is thus truly automatic, and fulfills all the requirements of the law. Not only in tests has it been shown to be the strongest coupler yet made, but in actual use it has given satisfaction to all railroads which have used it, and no complaints of broken parts have yet been heard.

BURDEN, RENSHAW & CO.

Mr. Howard Again on Two-Shoe Brakes.

APRIL 6, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your article in the *Railroad Gazette*, of March 27, referring to my communication on "One Shoe vs. Two Shoe Brakes" is written under a misapprehension of my argument which you state to be "based upon the astonishing theory that journal friction tends to stop the rotation of the wheel, but does not retard the motion of the vehicle." As I am quite unconscious of having propounded such an astonishing theory, I hope you will give me space for this reply. . . . The journal friction of a one-shoe brake seemed sufficient to account for the difference in the length of the stop (always in favor of the two-shoe) as this journal friction makes it impossible to use the same amount of shoe pressure as can freely be used on a two-shoe brake without sliding the wheels. I have not asserted that "journal friction tends to stop the rotation of the wheel, but does not retard the motion of the vehicle," but I did say that journal friction is not *effective* in stopping the motion of the vehicle. The retardation caused by the pressure on the journal is very much less effective than it would be if the journal were free and the momentum that is absorbed by journal friction was converted into rotation of the wheel and there taken up by the brake shoe, as it would then yield about ten times the retarding force. Hence the reason why a two-shoe brake can use higher percentages of pressure, without sliding the wheels than a one-shoe brake, there being no interference with the free conversion of momentum into rotation of the wheel, while a one-shoe brake reaches the point of wheel, sliding very quickly as the speed decreases and the length of the stop is proportionally increased.

You say "Mr. Howard assumes that he can use greater resistance to the rotation of the wheels than long experience indicates to be desirable." All our squeeze brakes are constructed to use 80 per cent. of the wheel weight, and that they do so I know to be a fact from actual test with pressure gauge upon the brake cylinder. I also know that we have never had a complaint of sliding wheels with this pressure. I, therefore, "assume" nothing when I say that a brake is not efficient that cannot use this pressure. . . . Captain Galton's experiments show that no brake is effective that does not use 80 per cent. of the wheel weight, and he expressly states that the most effective braking is done with a pressure of three times the wheel weight at high speeds, with a gradual reduction to a stop.

I am glad to note your approval of two shoe-brakes upon cars, especially passenger cars, and your enumeration of the advantages they possess over the one-shoe brakes, pointing out that these advantages fully justified the use of the additional mechanism required to operate them; but I am quite at a loss to understand why all these advantages should disappear when two-shoe brakes are applied to locomotives. JAS. HOWARD.

[Our readers will be glad to know that this is positively the "last word."—EDITOR.]

Starting Gear for Compound Locomotives.

53 STATE STREET, BOSTON, Mass., April 3, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It is rather surprising that the various letters which have appeared in the *Gazette* from Herr von Bories and Messrs. Hope & Co. relating to the relative advantages of the intercepting valve and Linder systems of starting gear for compound locomotives have not called out any discussion from railroad men. At the present time, when the compound locomotive is just appearing on American soil, this is to be regretted.

I take it that nothing is better proved than that the intercepting valve system is perfectly successful and satisfactory. Moreover, I take it that the reason for existence of the various Linder devices is their cheapness, and if an intercepting valve can be devised that is as cheap as a Linder device, the victory is more than won by the intercepting valve system.

The fact that one Linder device is only created to be followed by another, each one being the long-sought specific for the diseases of the compound locomotives, shows that they are not satisfactory. They are exceedingly ingenious, without doubt, as well as cheap, but I should be loth to advocate a perforated high pressure slide valve which is almost constantly leaking steam into the receiver. Steam is a rapid traveler, and the leakage through these holes must amount to considerable, especially at slow speeds. It is no argument to say that the indicator doesn't show it, as there are many hurtful phenomena which the indicator isn't delicate enough to show. We all know how leaky valves affect the economy of engines, and surely no one would think of running a locomotive with the cylinder cocks open. Will Messrs. Hope & Co. explain how they would expect an indicator diagram to look that shows leakage through the Linder equalizing ports.

In Messrs. Hope & Co.'s pamphlet on the Linder starting valve they assert that all intercepting valves close whenever there is a back flow of air or steam from the low to the high pressure cylinders, and thus endanger the receiver by too great pressure whenever the engine is reversed before stopping. This is by no means a necessary quality of intercepting valves, and even if it were, the safety valve, which should be on the receiver, would take care of the pressure. I fail to see that this differs at all from the effect of reversing an ordinary simple engine before stopping, and keeping the throttle valve closed.

Coming now to the general question of the compound locomotive from the economical standpoint, it is almost a platitude to say that the compound locomotive has no business to exist if it is not more economical in the consumption of steam and fuel than the simple locomotive, for the very obvious reasons that it is the more costly and ponderous. Nothing is better proved than that it is more economical than its predecessor to a paying extent. If its existence is due to its ecomony, how much more desirable is it when that economy reaches a maximum. Any probable extra cost of an intercepting valve over the Linder system will be surely more than justified. It is, in fact, very certain that an intercepting value can be made which will cost fully as little and be as durable as either of the Linder devices, and if this is so why should the Linder device be used?

I wish to say a few words concerning types of compound locomotives. The type that has come to stay is without doubt the two-cylinder type, for several reasons: 1. It is the simplest and cheapest. 2. It is the most economical. 3. Its working parts are the same in number and kind as those of the simple engine, and therefore more acceptable.

As to the question of economy, the compound engine saves steam because (*a*) for any given amount of expansion condensation is diminished, and it therefore (*b*) permits greater expansion, and thus (*c*) better utilizes high-pressures, which in themselves are to some extent more economical than low-pressure. The two-cylinder type of engine has less cylinder (that is condensing) surface per cubic inch of piston displacement than the four-cylinder type, and is therefore more economical than the latter. It permits the use of a re-heating receiver in the smoke-box, which the four-cylinder type as built does not, and is therefore again more economical than the latter. It is almost incredible that any designer of compound locomotives should sacrifice this valuable feature of re-heating steam in the middle of its expansion when it is free to all and so easily accomplished.

Among the lesser reasons for the economy of the compound locomotive may be mentioned the fact that if the high pressure valve leaks, the steam instead of either being wholly lost or not working expansively in that cylinder, finds its way to the low pressure cylinder which may have a tight valve, and thus work to some extent expansively. Another is that steam which is initially condensed in the high pressure and re-evaporates and thus does not work expansively in the high pressure cylinders, will work expansively in the low, and any water formed in the high will stand some chance of being re-evaporated in the receiver, and so work expansively in the low. F. W. DEAN.

The Rapid Transit Problem in New York.

BY W. HOWARD WHITE.

The question of rapid transit in New York practically resolves itself into three methods:

First—The occupation of another north and south avenue or street by a structure similar to that of the present elevated railroads.

Second—The use of a tunnel under a street or through the blocks.

Third—The use of an overhead structure high above the street surface and through the blocks.

The first method would undoubtedly be profitable and the franchise could probably be let for a handsome figure, but public feeling is so strong against this method, that it seems tolerably certain that the commission will not authorize it, though it appears that they are empowered to do so.

A tunnel through the blocks at any distance under the streets less than 30 ft. may be practically thrown out, because it requires as much expense for right of way as the high level schemes, and would involve nearly as much construction cost as the deep tunnel schemes, apart from the alteration of buildings on the line. It would involve all the well-known disadvantages of the underground systems, to wit, artificial light and ventilation, and rather poor air at best; excessive noise; absence of outlook and sunlight; greatly increased liability to accident, and much more serious results when such take place. It is sometimes assumed that artificial ventilation will make a tunnel equally as satisfactory as an open air road, but this point seems to need a little discussion. In the first place, even if such a road is to be operated by cable or electric power, there seems to be a generation from the damp surfaces of a tunnel of gas or fungi which the most perfect ventilation will probably never remove sufficiently to render the air as good as the air of a thoroughly well ventilated building above ground, and that is about 50 per cent. more impure than the ordinary outside air of a great city. If, now, the constantly vitiating air in the cars is to be replaced from this already inferior air, its condition can never be more than indifferent. Add to this the fact that the draughts into car windows or ventilators will be intensified by the confinement of the air passed through by the train, it will obviously lead to greater unwillingness on the part of the average passenger to the opening of ventilators. The result must be a high degree of vitiation of the train air as compared with overhead roads. So far as testimony on this subject exists, it refers to imperfectly ventilated tunnels, but such as does exist is conflicting. Mr. Harold Frederic, in the New York *Times* of Feb. 24 last, tells us that the new London Subway is perfectly fresh, while an apparently unbiased contributor to the *Railroad Gazette* of Jan. 16 last, says: "I do not think the ventilation good. Indeed, I believe it is purely fortuitous! There was a smell of damp cellar, suggestive of mycelium, a sort of old beer-cellar flavor not yet fully developed, and reminding one somewhat of the return air-ways of a coal mine. My head aches yet from the foul air;" and again: "It is likely, however, that much better provision must be made for ventilation. Undoubtedly to day the air was much vitiated, and probably it does not become changed at the shafts and staircases, but is merely churned to and fro in the tubes by the trains, and so is gradually accumulating carbonic acid from passengers, burning gas-lamps and tobacco. I am not alone in this opinion, and so mention it."

It will be borne in mind, too, that one of the functions which should belong to the ideal rapid transit scheme is the carriage of suburban trains from the connecting roads outside directly into the heart of the city without change of cars or engine. The tunnel ventilation problem, with this limitation added, under present motive power conditions, is practically hopeless.

The increased liability to accident under any tunnel scheme is unquestionable, being less under the deep tunnel schemes than under the others, because these admit a more direct alignment. It is obvious that in a tunnel—even a well-lighted and smokeless one—the main dependence for avoiding collisions must be the block system in some form. The automatic block is too liable to cause prolonged delay when something goes wrong to seem well adapted to a traffic of this character; and all hand block systems are liable, through the imperfection of the human intelligence or character, to

cause accident under certain circumstances. Where the driver of a train is able to see trains in his way, even when on curves, as on an open prairie, he works under much more secure conditions and will be able to proceed at some speed even when the signals that are expected to guide him are known to be out of order. It will always be more difficult, also, even in a well-lighted tunnel and on straight lines, to estimate the distance of a train ahead, and to make out whether it is standing or moving, than where a number of different objects alongside the track enable the runner to better estimate the distance and movements of a train in his way. Anyone who will try the experiment of watching a train from one of the New York elevated platforms at some little distance off, will probably be convinced of the utility of neighboring objects in assisting his judgment as to its movements and distance. The additional horror of underground accidents probably needs no demonstration—at least to a person with vivid imagination.

Taken altogether it will be generally conceded that an underground road will operate at a disadvantage in competition with an elevated one. It will be shown further on that this element of traffic is really the most important one in the situation. The result must be to eliminate from consideration shallow tunnels through the blocks.

As to similar tunnels under streets it is to be said, first, that the expense of construction will probably be nearly as great as for deep tunnels, owing to the expense of removing pipes, sewers and other obstructions; second, the element of possible damages will be great and uncertain; third, these tunnels would, in the lower part of the city, limit, in the streets where most needed, the spread of present facilities in the way of the pipes, wires, tubes and no one knows what kinds of future facilities, which cannot so well afford to pay for right of way as can a railroad.

It seems tolerably certain, therefore, that the deep tunnel schemes are the only underground ones worthy of consideration, noting that a road in open cut, as has been proposed for part of a rapid transit line, seems the worst possible means of rapid transit. It is liable, in addition to other difficulties which it has in common with tunnels, to blockade by snow.

Coming now to elevated roads, among the schemes offered to the notice of the commission there seem to be but three really practicable ones.

First, the Boynton bicycle, which is dependent on making a deal with the present elevated road, and is really merely an enlargement of their plant, with further interference with the light room of the street.

Second, the proposition to place an open work pier in each street with a pair of legs on each curb line, with truss bridges spanning the entire blocks between. The truss is placed with the lower chord at 110 ft. above street level, carrying four tracks, on two levels. This plan, as will be shown below, has the merit of accomplishing the object aimed at with much less capital than any other scheme of comparable advantages, and could be carried out with great rapidity and without being hampered much, if any, by obstructions in the way, and consequently with less and easier curvature. In view of the excellent foundation to be had almost everywhere in New York, there is hardly an element of conjecture in such a scheme. The cost could, therefore, be calculated with great accuracy in advance. The figures given for this scheme, as for all others, are based on building a bridge much beyond the requirements of any rolling stock now in use, in order to provide a structure, if not for all time, at least for as much time as it is possible to forecast the needs of.

The last class of schemes is that of a masonry viaduct through the blocks, the existing buildings being rebuilt to serve at once as supports for the structure, and as modern fireproof buildings, to be used for apartments, hotels, offices, or warehouses, according to the part of the city in which they might be. The difficulty with this scheme is the great cost and the more or less tedious nature of the proceedings necessary for obtaining possession of the right of way. It would seem, however, that the latter difficulty might be met by an additional provision in the law that sufficient deposit should be made with some trust company to cover the claimed value of the property in each case, and maintain such an income for the owner as might be shown by him as derived from the property taken, until the case could be permanently settled.

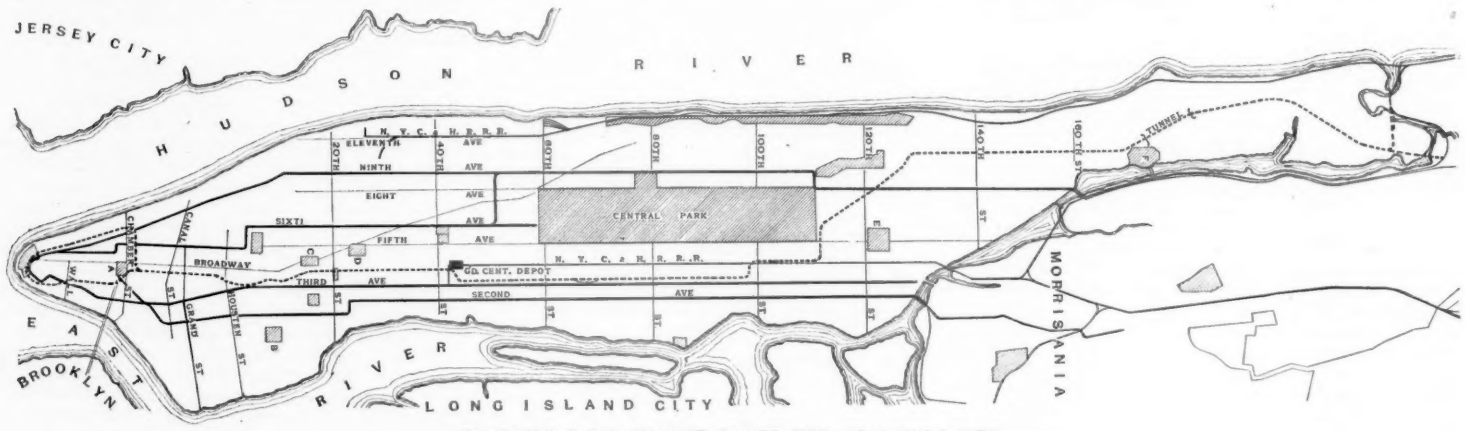
The plans on file with the Commission do not show in much detail just how such a scheme is to be worked as to the buildings, except that the People's Company has filed a reasonably specific plan and profile of their route, embracing a line extending (so far as Manhattan Island is concerned) from Spuyten Duyvil, at the Harlem, along the ridge overlooking the Hudson to 183d street, thence by tunnel under the Kingsbridge road to the east side of Tenth avenue at 170th street, thence southward on a line some distance west of the Central Park; and below it west of Seventh avenue to below Fortieth street; thence centrally on the island to a point north of Chambers street and east of Broadway, where the line forks. The east branch crosses the Brooklyn Bridge station, and the west one, running parallel and near to the North River, unites with the eastern one at the Battery and forms a loop. This line is a good one in the main, but seems open to criticism on the following points: It does not give connection with the Grand Central Station; it gives up the Harlem business, which is the best part of the island at that end; it leaves the thickly settled region east of the Park, which, with the Harlem business, enables the Third Avenue Railroad to carry 40 per cent. of the whole elevated traffic, and goes west of the Eighth Avenue line, where the business is comparatively thin. Now, if any one thing is certain in this matter, it is that the proposed line must go through the best paying region that exists to have any chance at all of paying.

Hence, the line estimated on below for this kind of elevated road, and also for the bridge structure, is that shown by the map herewith, which gives a line from the Battery to Kingsbridge on the east side of Central Park without interfering with a modern fireproof building, or with any building of serious importance, with the exception of Amberg's Theatre, south of Sixty-seventh street. Between Sixty-seventh and Sixty-ninth streets there is such a mass of important buildings on very high ground that it would probably be better to make a detour into Third avenue over the elevated line or east of the avenue, in order to avoid these buildings. The line is thenceforward clear of important buildings (except at 126th and 127th streets, where they could be crossed high up), clear to the Harlem. The route proposed would cross Tenth avenue at 170th street just over the street, run in tunnel from 173d to 183d street west of the Kingsbridge Road, thence follow the hollow along that road to the Harlem, connecting, as indicated, with the Hudson River Railroad just west of the new Harlem River cut-off.

The Peoples' Company has selected the above described line for a tunnel with excellent judgment, but they have laid down their route from the tunnel end to the Harlem more to the westward, and occupying more valuable ground. This appears undesirable, both on account of the greater right-of-way cost and because less central to the upper part of the island.

The line shown on the map has been selected to make connection between all down town ferries, the Brooklyn Bridge and the Grand Central Depot; to get as large a slice of the business between Third and Sixth avenues, below the Central Park, and between the Park and Second avenue as practicable, while incurring a minimum of expense for right of way. Above 110th street, by carrying an elevated structure directly over the Fourth avenue railroad tracks, the Harlem local business could be served and connection made at the Harlem River with the New Haven tracks, enabling their local trains to go down town. The branch to the west would build up and serve the undeveloped upper portion of the island and bring in the local trains of the Hudson River road. The only part of the island not relieved by this system is that west of Central Park. The traffic on this line would be considerably relieved by the competition of the proposed system above the park. Further relief might be given by raising the Hudson River tracks below Riverside Park above the grade of the street, after the manner of the present elevated roads, and by their connection with the Ninth avenue road at Twenty-ninth street, if the Gould and Vanderbilt interests could be sufficiently reconciled to effect this. It would seem to be to the mutual advantage of the parties to make such an arrangement, as it would lead to an increase, both in the Ninth avenue business by the additional passengers delivered to it, and to the Hudson River by the impetus given to local development along its line. The present grade tracks of the Hudson River are too great a barbarism to be tolerated indefinitely, and the raising of them in this way, would be a practical compromise between complete abandonment and retention where they now are.

In estimating on the cost of a masonry structure through the blocks, a plan has been worked out for arches over the streets, resting on cellular piers capped by transverse arches in such a way as to divide the space below as profitably as possible for business or dwelling purposes, particularly with reference to getting thin front and rear walls, in order not to interfere with the lighting of the buildings. The station platforms have been assumed between each pair of tracks, the outer tracks being looped out around the platforms, and used for the local business.



PROPOSED RAPID TRANSIT ROUTE FOR NEW YORK CITY.

Proposed Route in broken line; Existing Railroads in heavy full lines.

The "straight" right-of-way, so to speak, has been taken at 50 ft., providing for four tracks on the same level, and at 11 ft. centres, and with the outside track centres not less than 6 ft. from all structures. This width and clearance, except on curves, is sufficient for all rolling stock which is in general use in the United States, and the reduction from 12 ft., the more usual centre distance, gives an opportunity for light shafts on the sides of the buildings below, and allows somewhat for failure of lot lines to match on opposite side of a block or street, and for extra right of way on curves and diagonal crossings of blocks.

As there would be a good deal of this failure to match, however, in any event, it has been assumed in the calculation that an average of two and a half lots in width would be required, and that three additional 25×100 ft. lots would be taken for each station. Any masonry plan with the tracks on two levels would involve almost entire destruction of the space below by the size of the piers required and their concentration.

An attractive feature of this scheme would be a public passage through the blocks under the road, which, with the protection afforded by the arches over the streets, would offer a covered approach to the stations of the road from any intermediate street. The spaces on the ground floor along this passage work out very well into bazaar shops and stands of a great variety of sizes. Access to the road would be had, of course, by elevators, and in order to avoid multiplying these at any station, the elevator shafts could be massed in one group, passing up through one of the platforms and run sufficiently above the platforms to enable the passengers taking a train to get to either up or down trains by crossing a bridge and going *down* a flight of stairs, or by the latter only. In leaving the train, descent would be again made by a flight of stairs to take the elevator. The course or itinerary of the latter would be from the ground directly to the upper-level bridge, above the tracks, then down to the level below the tracks and then back to street level. Such an arrangement would entail at any minor station only one ticket seller at the street and two elevator attendants, who would control the ticket boxes, instead of the four men now generally required for these duties.

By a longitudinal cellular construction for the support of the tracks the space under them would be left available for a variety of pipes, conduits, cables, etc., so that rental of the spaces might prove a considerable source of revenue.

A structure in iron, with the spaces below filled with buildings, would be more economical, but it would be much more noisy for the occupants of the buildings as well as for the passengers over the road; would be more expensive for maintenance, and would give rise to troublesome problems as to the connection between the iron and masonry portions in the matter of tightness against weather.

In estimating on the tunnel scheme a tunnel 60 ft. wide at the spring of arch, by 30 ft. in height at the centre, has been assumed, any smaller size for the purpose being worthy of the opprobrious title of rathole, bestowed upon such by Mr. Richard Deeves in his communication to the *New York Times* of Jan. 11 of this year.

The estimate follows Mr. Deeves' figures with one important difference. Mr. Deeves has apparently estimated the tunnel excavation at $7 per yard. As the Aqueduct tunnel cost $6.67 per yard, the larger tunnel would certainly not show a better rate, in spite of the advantage of the larger section, for the reason that the conditions are much more unfavorable. In the first place the drainage conditions are much less favorable, all water having to be hoisted from shafts. The amount of water is likely to be greater at the greater depth with reference to tide water at which the tunnel would be, and with the close proximity of rivers on either hand. Secondly, the excavation from such a tunnel would be the most tedious in its character of any work on record. Every yard of rock must be hoisted up a shaft, loaded upon wagons, and the vast majority of it carried an average of a mile or thereabouts to tide-water, and then scowed to an indefinite distance, to be finally dumped. It will be borne in mind that the quantity of material from the tunnel would be so large as to make disposal on the island in its present conditions perfectly impracticable, unless with such haul as to be more expensive than the other plan.

On the other hand, Mr. Deeves allows only $638,000 per mile for brick lining and backing. Such lining could hardly be made safely less than 4 ft. thick for a 60-ft. span, and at 50 cents per cubic foot—a very moderate allowance for this work—this would amount to $1,267,200 per mile, which figure is therefore adopted. Mr. Deeves has allowed rather largely for rolling stock, but has omitted shops. His assumed length is 12 miles, but as it is 13¼ miles in a bee line from the Battery to Kingsbridge, this distance has been substituted for his. With these alterations, and an allowance for the general expenses of such an enterprise, and interest on the money invested while still unproductive, the account stands as given below.

No allowance has been made for freight stations in the tunnel or bridge scheme, the conditions being somewhat unfavorable for getting the necessary side track room without interfering with the streets.

In the case of the masonry viaduct, by connecting the loops between two quarter-mile stations by extra tracks on an additional lot width on each side, ample switching room could be had overhead. The buildings below, connected by car lifts with the tracks above, would afford ample facilities for unloading and storage, wagons being driven in on the ground floor and loaded and unloaded by suitable shoots and lifts.

CONSTRUCTION COST.

The line is from the Battery to Kingsbridge, with loop to ferries, and the estimate is based on spans of 240 ft., with piers 160 ft. from street to upper chord.

Cost per span with tower	$97,160	
Cost " of foundations	4,240	
Total cost per 260 ft. block	$101,400	
Cost per mile.		
20.2 blocks of structure at $101,400	$2,048,280	
4 stations, lifts and platforms, including land, at $120,000	480,000	
Land damages, 20 blocks, at $20,000	400,000	
Rails, ties and fastenings	30,000	
14.6 miles bridge at	$2,958.280	$43,190,889
* 0.65 " trestle at $678,000		440,700
* 0.64 " tunnel at $3,198,000		2,046.720
15.89 "		$45,678,309
Rolling stock		$5,600,000
Shops, block system, water supply and miscellaneous		1,000,000
		$52,278,309
Legal expenses, interest, superintendence and commissions, 12½ per cent		6,534,789
Total cost of bridge structure		$58,813,089

ESTIMATED COST OF MASONRY STRUCTURE.

The estimate is with right of way bought and fully built upon.

Battery to Ninety-seventh Street, with Loop, per Mile.

5 lots per block. 100 per mile		
Extra for four stations..... 12 " "		
112 lots at $35,000	$3,920,000	
Cost per lot of 6 story fire-proof building at 27c. per cu. ft., $37,857		
112 at $37,857	4,240,000	
		$8,160,000
Extra for supports and arching of railroad	$1,060,000	
4 stations per mile at $30,000	120,000	
Permanent way complete	30,000	1,210,000
		$9,370,000 per mile.

Ninety-seventh to 110th Street, Trestle Structure over Fourth Avenue, per Mile.

Iron trestle at $100 per ft	$528,000	
Permanent way	30,000	
Stations	120,000	
		$678,000 per mile.

110th to 170th Streets, per Mile.

Land, 112 lots at $20,000	$2,240,000	
Buildings	4,240,000	
		$6,480,000
Construction, permanent way and stations		1,210 000
		$7,690,000 per mile.

170th Street to 183d Street, Tunnel and Approaches, per Mile.

Tunnel and lining	$3,000,000	
Permanent way	30,000	
Land damage	48.000	
Stations	120,000	
		$3,198,000 per mile.

*See estimate for masonry viaduct.

183d Street to Kingsbridge, per Mile.

Land, 112 lots at $8,000	$896,000	
Buildings	4,240,000	
	$5,136,000	
Construction, permanent way and stations	1,210,000	
	$6,346.000 per mile.	

Cost of Total System, Battery to Kingsbridge.

Battery to Ninety-seventh street	8.5 miles,	at $9,370,000	$79,645,000
Ninety-seventh street to 110th street	0.65 "	678,000	440,700
110th street to 170th street	3.6 "	7,690.000	27,684,000
170th street to 183d street.	0 64 "	3,198,000	2,046.720
183d street to Kingsbridge	2.5 "	6,346,000	15,865,000
	15.89 miles.		$125,681,420
Connection with New York Central			50,000
Two freight stations, with heat and light plant for system			1,680,000
Rolling stock			5,600,000
Shops, block system and miscellaneous			1,000,000
			$134,011,420
Legal expenses, interest superintendence and commissions, 12½ per cent			16,751,428
Total cost of masonry structure			$150,762,848

COST OF DEEP TUNNEL LINE, BATTERY TO KINGSBRIDGE DIRECT.

Excavation, per mile	$2,860,000	
Lining, per mile	1.267,000	
Permanent way, per mile	30,000	
Stations, per mile	120,000	
Land for stations, per mile	420,000	
13¼ miles, at	$4,697,000	$62,235,250
Rolling stock		5,600,000
Shops, block system, and miscellaneous		1,000,000
		68,835,250
Legal expenses, interest, superintendence and commisions, 12½ per cent		8,604,406
Total cost of tunnel scheme		77,439,656

The income derivable from the different schemes is stated below, on the basis of a single five-cent fare from the Battery to Kingsbridge. On this basis any of the schemes is seriously handicapped in comparison with the present elevated system, whose longest five-cent ride is less than 10 miles in length against about 15 on the proposed Battery-Kingsbridge elevated lines. This difficulty would also make it hard to operate through trains from the suburbs into the city without change. If, however, proper authority were conferred to collect extra fares, say, above 155th street, it is probable that some satisfactory ticket-collecting arrangement could be devised without change of cars.

INCOME.

Bridge Structure.—The income account of the bridge scheme may be estimated as follows: If the passenger business be estimated at three-quarters of the present elevated railroad income from the Third and Sixth avenue lines, or, say, equal one-half of the whole income of the Manhattan, it would at present amount to about $2,000,000 net. It seems fair to assume as much as this in spite of somewhat greater operating expense, in view of the section of the city traversed and of the greater length of line, and also in view of the greater agreeability of a line without stairs to climb, freer from noise and with more agreeable outlook. This $2,000,000 would give less than 3½ per cent. on the estimated cost of $58,000,000. If, now, we turn to the possible maximum business of such a road in order to get a figuring basis, assume the trains fully occupied, that is, all seats taken for 14 hours per day. If the trains are one minute apart on each track of the four, and each train of eight cars seats 400, the annual capacity is $365 \times 400 \times 60 \times 4 \times 14 = 490{,}560{,}000$ passengers at 5c. = $24,523,000, or perhaps $12,000,000 net. This would give a return on the capital outlay of 20.7 per cent.

Masonry Structure.—In the case of the masonry structure the income would be made up of: 1st. Rents of buildings; 2d. Passenger income; 3d. Freight income, and 4th. Rental of conduit space (disregarding in all cases income from carriage of mails and express matter). Referring to the estimate we have:

Building investment.

Battery to 97th street, 8.5 miles	@ 8,160,000 =	69,360,000
110th street to 170th street, 3.6 miles.	@ 6,480,000 =	23,328,000
183d street to Kingsbridge, 2.5 miles	@ 5,136,000 =	12,840,000
		105,528,000
Income from this at 4 per cent., to take a conservative figure, is		4,221,120

2d. The passenger income would be same as from the bridge structure.

3d. The freight business practicable seems exceedingly difficult to guess at; 400 cars per day with a rate of 15 cents per ton, including terminal charges, a low rate for the character of freight to be expected, namely, jobbing goods, would be as little as would make it pay to make the estimated outlay for freight stations. This would give a net return of, say, $120,000, after deducting 50 per cent. for expenses.

4th. Allow for rental of conduits, 16 miles at 4,000, $64,000, we then have:

Income Account.	
Building rental	$4,221,120
Passenger income	2,0 0,000
Freight "	120,000
Conduit rental	64,000
Total	$6,405,120

or 4.3 per cent. on $150,000,000.

The maximum in this case figures out as follows, the freight income and conduit rental being pure guess work, but kept low enough to be apparently quite safe:

Building rental as before	$4,221,120
Passenger income	12,000,000
Freight "	300,000
Conduit rental	100,000
	$16,621,120

or 11 per cent. on the capital invested.

Tunnel.—On the tunnel scheme, if the same passenger income be assumed, we have minimum and maximum returns of 2.6 per cent. and 15.6 per cent. The prospect of even the smaller figure being realized at once seems small in view of the unattractive character of the method of transit.

So many estimates of a general character have been given on the cost of a tunnel system under New York, showing a much smaller cost than the above, that it seems necessary to call attention again to the fact, that, so far as known to the writer, none of these except that of Mr. Deeves, above referred to, have gone into any detail that could be analyzed.

It seems to have been assumed that the driving of a tunnel under New York was one of the simplest and most inexpensive things in the way of tunneling that could be found. The facts as pointed out above are these: The tunnel would have to be driven through a rock generally hard, and almost always treacherous. The use of a shield in view of the blasting required would be impracticable. The quantity of water to be expected would be enormous, judging by the results of wells in different parts of the city. The cost of handling the material, as pointed out above, would exceed that of any known tunnel, so far as can be judged in advance.

An iron lining would be impracticable for a four track tunnel on account of the expense for so great a span with probable irregular and uncertain loading. If four small tunnels were driven the expense of driving them would be enormously increased. The flanges of the iron lining add to the noise inseparable from a tunnel with any known rolling stock and permanent way, except possibly the "glissade" track exhibited at the last Paris exhibition.

The result of this investigation is to confirm the conclusion reached by the very original and entirely different method of Mr. Cooper in your recent issue, that the franchise for building a rapid transit railroad in New York (other than by an elevated structure in a street), in competition with the present elevated system, is one requiring subsidy and not one for which capitalists will pay money or which they will undertake without assistance.

The most feasible method would seem to be by guarantee, on the part of the city, of a limited interest on the investment, viz., that it would make up any shortage below the rate fixed upon, with release of the property from taxation for a limited period. The commission having determined the most practicable route and method, might ask the legislature for power to make such an arrangement with the party who would bid for the franchise at the shortest term of tax release.

April 6, 1891.

Block Signaling.*

[Mr. Paine's paper dealt with many things with which our readers are already familiar; therefore we reproduce but a small part of it. It will probably be published in full by the club.]

Permissive blocking does not strike me as being blocking at all. Its success depends on the combined action of two persons who must both obey their rules promptly and correctly. In order that the system may prove a success, the flagman must run back a long distance as soon as the train slackens speed, no matter what the weather may be, no matter how tired or sleepy or lazy he may be, and the engineman must be on the lookout for the flag at every moment. He must not be attending to any of the multifarious duties devolving on him, but must give his whole attention to the track in front of him, so far as his eyes are concerned. The engineman must, first and foremost, make his schedule time, or, if late, something more than schedule time; he must also run carefully under the permissive signal.

Does any one doubt what the result will be? He always has and always will argue when placed in a similar position, either that the train against which he has been cautioned has got out of the way or else that the flagman of that train has been sent out to protect it. On the other hand, the flagman, knowing that he has the protection of the signal behind him, reasons that the engineman of the following train has been cautioned against the train in advance and that he is running carefully under a green signal. Then the inevitable happens. The engineman is in a hurry, the flagman is either tired or careless or lazy, and there is a collision with the usual results, which your are all familiar with, in the way of wrecked cars, and burned, mutilated and suffering human beings. In view of the above facts, I suggest in all sincerity that the term "permissive blocking" be abandoned, to be replaced by the more appropriate expression "pernicious blocking." . . .

At the present time the question of night signals is agitating the minds of railroad officials in general, and signal engineers in particular, and very justly so, for our present standard, or rather want of standard, is most unsatisfactory in every way.

There are many different arrangements of the lights for indicating the positions of signals at night. The most common plan is a green light for caution, a red light for danger and a white light for safety. This plan, although advantageous for its simplicity, may well become, from the breaking of a red or green glass, a source of the greatest danger. I know of several well-authenticated instances where this has occurred. The signal engineer of a well-known road told me not long ago of a case in his knowledge where a serious collision through this cause was averted only by the presence of mind of the engineman, who brought his train to a stop in the face of a white signal, because he knew or suspected that the signal was wrong. The multiplication of lights is a common resource for avoiding the before-mentioned danger, and is practised on many roads. It, however, has many disadvantages, the principal ones being excessive cost of manufacture and maintenance, and the possible confusion of having so many lights. The ideal semaphore would, without reference to color, show at night a brilliantly illuminated arm of approximately the same size and shape as the arm appears by daylight. A very close approach has been made to this semaphore, which, how-

*A paper read by Mr. G. H. Paine, Signal Engineer, before the New York Railroad Club, April 16, 1891.

ever, is susceptible of some improvement. In my own opinion a slight increase in the intensity of the beam of light, together with the decrease in the cost, which would follow the manufacture of it in large quantities will make it a very desirable adjunct to any block or interlocking system.

There are very few railroads east of the Mississippi, north of the Ohio and south of a line at about the average latitude of the St. Lawrence River which could not very easily and with little additional expense establish block signals at their regular stations, maintaining a nearly constant distance between them of five or six miles; I refer now to a single-track. I believe I am not wrong in assuming that on ordinary railroads trains will average a speed of twenty miles an hour. At this speed and with block stations five miles apart an apparent traffic of 96 trains in 24 hours is accommodated—on the assumption, however, that there shall be no breakdowns, no stops, a constant speed of 20 miles per hour, and a passing siding at each block station. These conditions are of course impossible; for there will be breakdcwns, must be stops for passengers, freight and so forth; but by taking one-half of 96—that is, 48—we are, I think, quite within the bounds of probability, and at the same time make quite a respectable showing for a perfectly safe train movement on a single-track road. Examine this proposition carefully, and you will see that with 24 trains each way a day, moving at the rate of 20 miles per hour, with block stations 5 miles apart, there will be a distance of 20 miles between each two trains moving in the same direction. Please do not understand me as saying that under ordinary circumstances there must be a space of 20 miles between each two trains—for it is not so. They may be any distance apart, so that it is not less than 5 miles.

Again, suppose the block stations are only four miles apart, while the trains run at the same speed as before. The apparent traffic would then be equal to 120 trains a day. Taking one-half of this as possible, we should have an actual traffic of 60, that is, 30 trains each way a day, with an interval of 16 miles between each two trains moving in the same direction.

There seems to me nothing impossible in this arrangement, and, while my figures are necessarily of an empirical character, they prove how perfectly possible and positive a block system may be.

The number of trains which may be run on any piece of road every 24 hours is determined through the combination of so many different conditions, besides the length of blocks, that no rule can be depended upon. What I wish to insist on is the fact that absolute blocking is just as necessary and quite as possible on small roads with a light traffic as on roads with a heavy train service. Many things tend to increase the capacity of a piece of track—frequent and overlapping passing sidings, isolated pieces of double track, etc.; and as the capacity of a railroad naturally grows with the demand made upon it, so must the block system.

The method I have been describing is of the most elementary character. It requires nothing but the telegraph operator, who would be needed at almost every station even if there were no block system, and a two-arm semaphore post connected with the telegraph office by a piece of wire or chain.

With blocks averaging five miles in length, the first cost of materials necessary would not, I believe, much exceed fifteen dollars per mile. The increased cost of operation would vary greatly over and above certain fixed charges, such as oil and waste for the signal lamps; it might easily be very little, and could not be very much. The most important item would be the additional operators required over and above those necessary for the ordinary work of the road. This would depend greatly on the ingenuity and care used in the locating of the block stations. . . .

[Mr. Paine here described the Hall, the Union and the Westinghouse electro-pneumatic systems.]

I am not in a position to know what the exact cost of maintenance is of the electro-pneumatic. I have been told, however, by persons using the system that the signals should be properly maintained at an expense of about $90 per block per year. This would include the fuel, oil and waste necessary for operating the compressors and filling and cleaning the lamps, as well as the pay of all men employed in inspecting, operating and maintaining the system.

Although the cost of a plant of this character is large at the start, the cost of maintenance is so slight in comparison with the cost of maintenance of a mechanical system that its advantage will be seen at once. On a certain railroad the system of pneumatic-automatic signals has been put in, embracing a section of road seven miles long, four main tracks, with the block signals about half a mile apart. A mechanical system of the same length, with the block stations the same distance apart, would have cost to erect less than half as much as did the automatic pneumatic. The cost of operating the mechanical system for one year, however, including the pay of operators, 22 of whom would have been required, would have been equal to about three times the sum which it has cost to maintain and operate the automatic, and in four years from the date that the automatic system was put in service this saving will have much more than paid for it, without at all taking into consideration the entire immunity from collisions which has been procured. This proportionate gain increases rapidly as the length of road protected is increased.

To give another illustration, all the elements of cost of a 14-mile section of double-track road, with the blocks varying from 1,500 ft. to 2,650 ft. in length, have been estimated. To erect a mechanical system of the same size would have cost somewhat less than one-third as much. To maintain and operate the mechanical it would have cost four times as much as would the pneumatic, and the net yearly gain in favor of the pneumatic would have paid for it in the amazingly short time of two years. . . .

Some Railroad Crossings at Chicago.

With the large number of eastern and western systems of railroads obtaining an entrance, one after the other, into the heart of the city of Chicago, there have been established many complicated systems of tracks, not only for main-line but for yard purposes. Each road, as it procures a right of way into one or the other of the half-dozen great passenger stations, is obliged at times not only to use the tracks of existing lines, but to cross and recross many opposing lines. The Alton and Burlington roads use the Ft. Wayne tracks, the former north of Grove street and the latter north of Sixteenth street, the Chicago, St. Paul & Kansas City uses the Wisconsin Central or Chicago & Northern Pacific tracks for quite a distance out; the St. Charles Air Line is used by and jointly owned by the Northwestern, Burlington, Illinois Central and Michigan Central for transfer from the west side of the river over to the lake shore. The Chicago, Madison & Northern, which is a proprietary line of the Illinois Central, will use these tracks east of the Air Line crossing, and the Western Indiana brings into the Polk street station some half a dozen or more lines. So that now, besides being extremely hard to pick out any good way of getting in at all, when that way is found it proves to be enormously expensive. Notwithstanding the fact that there are several of these passenger stations it is rapidly becoming a problem in some cases how to handle the trains at certain hours of the day. When the handling of a heavy suburban service and the departure of through trains occur at the same hours of the day on several large roads running into a single station, the question of changing a time card is a rather serious affair.

For the transfer and shipment of freight, this subject of track facilities is one of very grave importance. The number of freight houses is legion, and they are located in all parts of the city. This is not only true of the roads in general, but with some allowance is true of individual roads. The Northwestern, for instance, has large freight depots in several quarters of the city. The effort to get at their respective depots by each of the roads, it will be readily seen, produces a complicated network of tracks which, as a whole, will give one abundant exercise for his ingenuity for some time.

The worst tangle which we know is the one illustrated here, extending from one-half to one and a half miles south of some of the principal passenger stations. Some time ago there was a move on the part of several of the entering roads to attempt to better the condition of affairs in this section of the city, and Mr. E. L. Corthell undertook to bring about some concerted action among the different companies for overcoming a part of the difficulties existing at these three points. Most of the study has been done at the Stewart avenue crossing, and it is here that the immediate work is to be undertaken.

The tracks east of the Indiana elevator are to be changed by crowding the Western Indiana tracks over, and giving space for a sixth track where now there are but five. From a point where the Santa Fé and Chicago, Madison & Northern cross the Fort Wayne, a double line of slip switches is run across the Alton and into the Western Indiana tracks, enabling the Santa Fé to use their Indiana tracks for their passenger service, the three tracks southeast of the Chicago, Madison & Northern being used for freight only. The work for this portion is now being pushed by the Morden people, who are making 45 crossings and 65 switches with frogs, besides 21 slip switches and all of the cut lengths. Every piece is finished and marked at the shops, and when laid down on the ground the whole needs only to be bolted together. The changes at the Air Line crossing at Sixteenth street were made by this same frog and crossing company a little over two years ago. They put in 125 crossings at that point.

It was proposed to put in a double crossover between the Santa Fe and Chicago, Madison & Northern near Twenty-second street so as to give opportunity for using the two Chicago, Madison & Northern tracks crossing the Western Indiana as a double-track system. This would facilitate the movement of two trains of the same road going in opposite directions, but would not allow two trains of opposite roads to cross the Fort Wayne tracks in opposite directions, as there would be a fouling point both east and west of their north and south tracks. A westbound Chicago, Madison & Northern train would foul an eastbound Santa Fe train at a point east of the Fort Wayne tracks, and an eastbound Chicago, Madison & Northern train would foul a westbound Santa Fe train just west of the Western Indiana tracks. Any such arrangement of crossovers would necessitate moving back the derailing switch so far that it would not be sufficient protection for the main crossing. Thus there are two sides to the question, and, although there are disadvantages in being confined to a single track for a short distance, still it has been thought best by some to put up with this inconvenience rather than adopt the other plan.

The two Alton tracks sandwiched in between the others east of the Ft. Wayne are old freight tracks. It will be noticed also that the two main-line Alton tracks cross each other soon after leaving the Ft. Wayne on account of this latter road running trains on the right-hand track, whereas the Alton uses the left-hand track.

Mr. Corthell's scheme is to erect a pneumatic interlocking tower at each of these three systems of grade crossings, and to erect a power-house at some centrally located point so as to supply power to the three interlocking systems. All three towers are to be connected by a system of electric calls and signals, so that when an outbound Pennsylvania train passes the Sixteenth and Canal street tower it will notify the man at Stewart avenue and Grove street. Likewise when an outbound on the Santa Fé passes the Sixteenth and Clark street tower that tower will notify the Grove street tower. Thus Grove street, knowing that both trains are coming and must cross, can judge which should have the right of way, and set his switches accordingly.

Each tower will have a man in charge who will have complete control over all interlockings at his crossing, the only connection between the several towers being for purposes of notification, as by telephone, bell calls or automatic sight warnings. There will be a superintendent over the whole, whose duty will be to see to the keeping up of all machinery and appliances about the plant.

The size of such an undertaking as advocated by Mr. Corthell can be realized when it is considered that the interlocking at Stewart avenue alone would require a tower of nearly two hundred levers; and in order to run these crossings, as may be allowed by the new law, it becomes very essential that the pneumatic systems should work perfectly in every respect; and also, to give the most efficient service, there will be required a quick, clear-headed man in charge at each tower. This is illustrated by the count made at the Air Line crossing about a year and a half ago, when it was found that there passed over this crossing 1,063 engines, 1,202 coaches and 4,825 freight cars in one day, showing that if the blocking of trains is to be reduced to a minimum it is necessary to have the right man at the levers.

The idea of interlocking is strenuously opposed by some of the roads which have had little or no experience with the more improved methods and which think the old style the safest and best; but as the traffic is yearly increasing and already demands heroic treatment it is to be hoped that some such scheme as the above may be carried out. Taking into account the fact that these several nests are already established and that it is out of the question to tear them out and make a fresh deal, it would seem that the proposed plan would meet the requirements of the greatest number with the smallest amount of alteration. Should the interlocking plant be put in at Stewart avenue and Grove street, the improvement of the train service would be so noticeable that we doubt not the roads now objecting to this triangular plan would be glad to swing into line and become as strong advocates of interlocking as any of the others.

This enterprise is being pushed by J. F. Wallace, who has been for so long associated in business with Mr. Corthell, and who at the beginning of this year received the appointment of Engineer of Construction of the Illinois Central Railroad. Very great and, in fact, extraordinary difficulties arise in carrying out the scheme, from the numerous and often conflicting interests of the roads. Even where their interests do not conflict, there is often a mutual distrust which makes any agreement hard to get and harder to keep.

Pipe Culverts on the "Plant" System.

BY W. B. W. HOWE, JR., CHIEF ENGINEER.

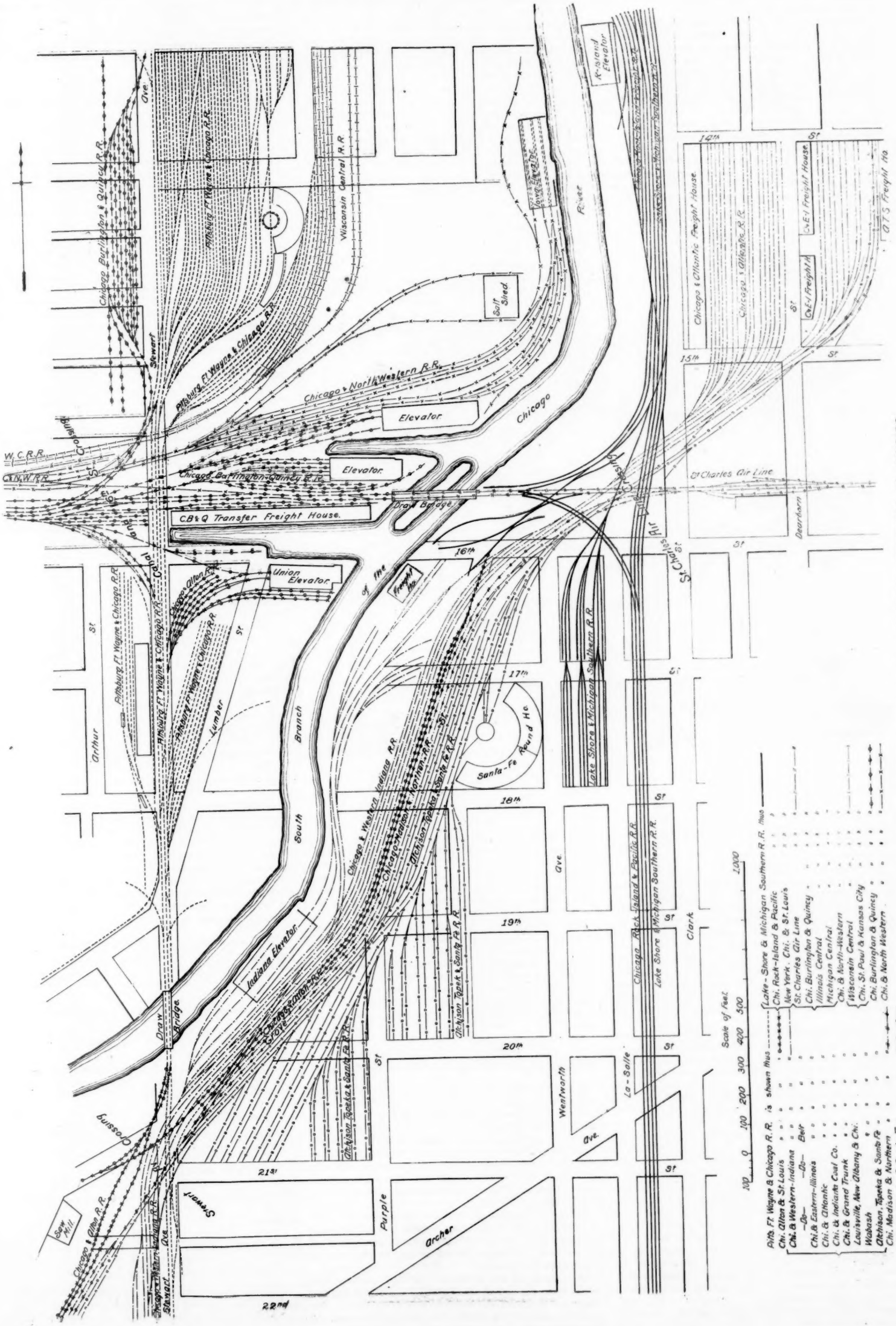
There is perhaps no one item in railroad construction and maintenance, which is of more importance in a small way than the proper treatment of the minor streams or drains, which must necessarily be crossed by the road-bed, where perhaps, an area of two or three square feet, is all that is necessary to afford ample passage for the water. To provide for these, not simply in the sense of getting the track over them, but to dispose of them in such a manner that they will require little or no attention from those charged with the maintenance of the track, limits discussion to cases where permanent rather than temporary construction is recognized to be conducive to true economy.

The accompanying plans illustrate in a general way the standard practice of the Plant System, in the use of culvert pipe, which is employed in new construction wherever circumstances will permit, and will eventually replace the small trestles upon the older portions of the system. A short description of the conditions under which culverts of this character are found to be serviceable, and a few notes as to the proper methods to be employed in their construction, may be of interest.

A perfect road bed can best be obtained by preserving uniform bearing for the cross ties at all points. This idea has found expression in the practice of carrying the track ballast even over iron bridges, whose floors are specially designed with that end in view. There are cases it is true, in which this cannot be done, but where possible to adopt such a course, few will question the advantages to be derived from it. The difficulty of maintaining uniform conditions of line and surface, and of securing a smooth and easy-riding track, in the rapid transition from a well-ballasted bed to a rigid bridge floor, and *vice versa*, can only be fully appreciated by those whose duty it is to attain these results.

Where a stream is of sufficient importance to warrant the expenditure of a considerable amount for a masonry arch or iron bridge, the matter is usually placed beyond the everyday care of the section men, but the petty openings are disposed of too frequently in a temporary manner involving constant expenditure for maintenance, absorbing a portion of the time that should be expended upon the track, and destroying that uniformity in the condition of the road bed, to which reference has just been made. The use of culvert pipe offers a comparatively cheap method of providing for such cases, in a permanent and thoroughly satisfactory manner, subject, however, to two limitations, the height of the bank, or the depth at which the pipe can be placed below the track, and the total area of water-way required.

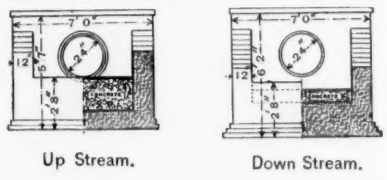
There should always be sufficient earth interposed between the top of the pipe and the cross ties, to afford a good cushion. One and a half diameters of the pipe should be the minimum in good practice, although in special cases, one diameter may answer, There is no



SKETCH MAP SHOWING SOME OF THE RAILROAD CROSSINGS IN CHICAGO.

maximum limit, for if the pipe is properly laid, no weight of bank can crush it in.

The limitation as to the water-way required is one of cost. It can readily be seen, that as the area of the pipe culvert is increased by multiplying the number of pipes, while that of a "barrel" culvert, for instance, depends upon the radius of its cross section, there will be a point at which it may be cheaper to use the latter. Neither the "barrel" nor arch culvert, however, is applicable to openings in very low banks, and, within the above limits, there seems to be nothing comparable to good vitrified clay pipe for economy and durability. Nowhere can it be said with greater degree of truth, that "what is worth doing at all, is worth doing well." Parsimoniousness in material, and careless workmanship here, will eventually defeat the end in view. The object is not to save a few dollars in first cost, but to improve the condition of the track, and at the same time to secure something whose maintenance will not be a constant source of expense.



PIPE CULVERTS.

It is of the first importance, that the size of the culvert, as of any other water-way, be proportioned for the quantity of water to be passed, with due regard to any head that may at times exist. Familiarity with the locality and characteristics of the country, are safer guides than any formulæ which may be used to determine the required area from the water-shed and rain-fall. Particularly is this true in a low, flat country, where the divides are difficult to define and no very accurate record of the rain-fall is obtainable. The recollection of the "oldest inhabitant" is frequently of great assistance in important cases in enabling the requisite area to be determined.

Assuming that the culvert has been properly proportioned, so as to give sufficient water-way, it may fail through faulty construction. Good materials are a prerequisite. The pipe should be of the first quality, extra strong, thoroughly vitrified and salt glazed both outside and in. The lengths of the sections depend somewhat upon the facility with which they can be handled; the smaller sizes being lighter, might be used in even greater lengths than they can be had of the manufacturers. The large sizes are made in lengths from 2 ft. to 2½ ft., the latter dimensions being generally preferred. Deep sockets are desirable, as they afford better means of securing water-tight joints, which in some soils is essential. They further add considerable strength to the line of pipe in case of any slight lack of uniformity in the foundations. The difficulty of obtaining perfectly tight joints with the shallow sockets renders it necessary in certain cases to take extra precautions against leakage. The pipe should be well formed, free from warps, and truly circular in section, the spiggots fitting into the sockets so as to leave a sufficient space all around for the cement. Each section should be tested by tapping it lightly with a hammer, by means of which even a small crack not apparent to the eye can be readily detected. No defective section should be used.

Practice differs somewhat as to the method of preparing the bed upon which the pipe rests. Frequently a bed of concrete is prepared, in which the pipe is bedded up to its centre. This makes an excellent foundation, and may be advisable where it is impossible otherwise to secure tight joints, but with the deep bells the joint can be made so perfectly secure that the extra expense of the concrete is unnecessary. The main object is to provide a solid and permanent bed for the pipe. There is, of course, a possibility of some joint leaking and of the foundation being softened if the pipe be laid in ordinary soil, and it is well to provide against this, where it can be cheaply and readily done. With such pipe as has been recommended it is all sufficient to level off the bed about two feet wider than the diameter of the pipe, and to consolidate it by ramming in broken stone or brickbats until thoroughly compacted. The pipe is laid upon this bed, care being taken that the bells have a good bearing and that the earth is thoroughly tamped under each section. The tamping must be thoroughly done, so as to support the pipe through its entire length and on both sides; it should progress with the filling until the pipe is covered. It is important that both ends of the culvert be protected by a brick or masonry wall, laid in hydraulic cement mortar.

Culverts are frequently laid without any protection of this kind, and in such cases the weak point is the outlet, where the water falling from the pipe cuts away the earth, causing the end section to fall in, the process being repeated for each joint in turn, until the whole is destroyed. If the discharge end is properly protected from being thus undermined, failure may still be due to the intermediate joints being crushed in. Whenever this occurs, pre-supposing the pipe to have been of good quality and put at sufficient depth below the track, bad workmanship in indicated. It is rare that proper precautions are taken to prevent failure of this kind, unless the work is done under the supervision of some one fully alive to its importance.

The pipe should be laid bells up stream, and all the joints fully packed with a mixture of one part hydraulic cement and one part sand, mixed together dry, and moistened with just sufficient water to make the mass coherent. This, packed firmly with a smal rammer, will make a much more solid joint than can be obtained with mortar applied in the ordinary way.

Where the joints are imperfect, the water passing through the pipe, under even a very slight head, will escape at any leak that may exist, and, should the bed be of material not suited to resist more or less scour, the pipe sooner or later will be deprived of its support and crushed in. It is not uncommon for scour to take place at the inlet end, which should also be well protected.

The cost of culverts of heavy double-strength pipe will depend in a great measure upon the cost of transportation of the pipe, but even at long distances from the manufacturer's yards they can be put in at much less expense than equally durable construction in brick and stone.

SAVANNAH, Ga., April 4, 1891.

Machine Shop for the Link Belt Machinery Company.

This building was designed and built by the Berlin Iron Bridge Company. It is 405 ft. long by 124 ft. wide, being divided into a central portion 41 ft. 8 in. centre to centre of columns, and a wing on each side 40 ft. from the centre of columns to the outside of walls. The floor of the gallery in the wing portion of the building is supported by columns placed 13 ft. 8 in. from the inside face of the wall, or 20 ft. 4 in. from the centre of the crane girder columns. The roofs are flat and covered with tar and gravel.

The central portion of the building is served by a 25-ton hydraulic traveling crane, which moves back and forth the whole length of the building, and the wings are served by jib cranes placed as may be required for the different machinery.

The height to the underside of the gallery floor in the wing portion of the building is 15 ft. 3½ in., and the actual height of the upper floor is 11 ft. 6½ in. The central portion of the building is 35 ft. 5¾ in. from the floor to the top of the rails which carry the traveling crane.

The interior is lighted by side windows in the outside walls, and the central portion of the building by windows in the sides of the lantern trusses. Lengthwise, the crane girders are supported on columns 36 ft. apart, and the columns which support the gallery floors are placed 24 ft. apart.

Oil-Mixing Plant of the Lehigh Valley Railroad.

BY C. P. COLEMAN, CHEMIST, L. V. R. R.

III.—DETAILS AND RESULTS OF OPERATION.

Handling of Oils.—As before stated the plan adopted for mixing oils is by blowing air through them. This plan has been adversely criticised in some quarters on account of the supposition that the air passing through the oil caused oxidation to take place. The experience of the road has proved that this is not the case, at least not to an extent that is injurious to the working qualities of the oils. The advantages of this method of mixing are economy of first cost and operation and the more thorough incorporation of the oils entering into the compound. When a batch of oil is to be mixed the amount of each brand that is to enter into the compound is weighed out in accordance with the prescribed formula, and the amount entered in the engineer's diary; the oil is then poured into the troughs on the side of the "supply and discharge room," which are connectedby-pipes with the mixing tanks in the room below, the lightest oil being run in first. Certain tanks are desig nated to be used for similar grades of oil in order to prevent an admixture of oils that would be injurious. For instance, a tank is set apart for mixing signal oil, for the reason that any of the heavier oils would injure the burning qualities of this brand. Cylinder stock oil and well oil are received in tank cars, and these cars are run into the "tank car discharging house," and after being heated to about 70 degrees Fahr., the oil is run off by means of pipes to the large tanks in the "storage tank room," of which there are two, one for each brand. From these tanks the oil is pumped into the mixing tanks, the amount so pumped being measured by means of a glass gauge on the mixing tank, which has a scale behind it divided into the number of gallons. The number of gallons is converted into pounds before being entered in the engineer's diary. All other oils, excepting tallow, are run into the mixing tanks as above described.

Tallow is first weighed and then melted in the tallow tank and from that run into the dumping trough leading to the tank below. After the proper ingredients are run into the mixing tanks, steam is turned on and the oils heated to the proper temperature; the blower is then brought into use and the mixture agitated for a stated period, the temperature being kept at the specified point. After the oils are thoroughly mixed they are pumped from the mixing tanks to the supply tanks in the "discharge and supply room," where they are allowed to remain until they become cool. At a convenient time the oil is drawn off into barrels which have been branded and weighed. The filled barrel is then weighed and the net weight and batch number marked on the head of the barrel. By marking the batch number on the head of each barrel the history of any oil which does not prove satisfactory in service can be traced to the batch number corresponding in the engineer's diary, where the ingredients with the lots from which they were taken can be found. The engineer's diary is a book kept by the engineer, in which he records the time consumed, the time of blowing, and the ingredients entering into each batch. The record is made in duplicate, one copy being kept on file at the works, and the other forwarded to the Chemical Department for making up the cost of the batch. The form is as follows:

LEHIGH VALLEY RAILROAD.—OIL WORKS.

Batch No.....

Perth Amboy, N. J.....189..

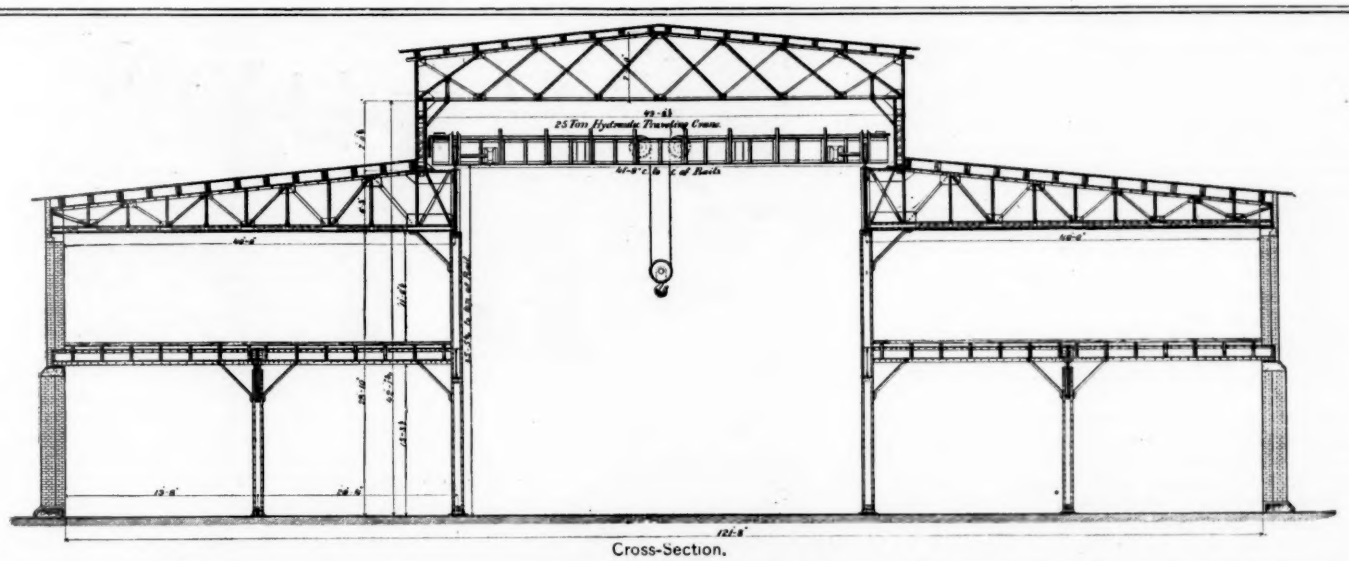
Time of starting work..... Time of starting blowing.....

" stopping " ..... " stopping " .....

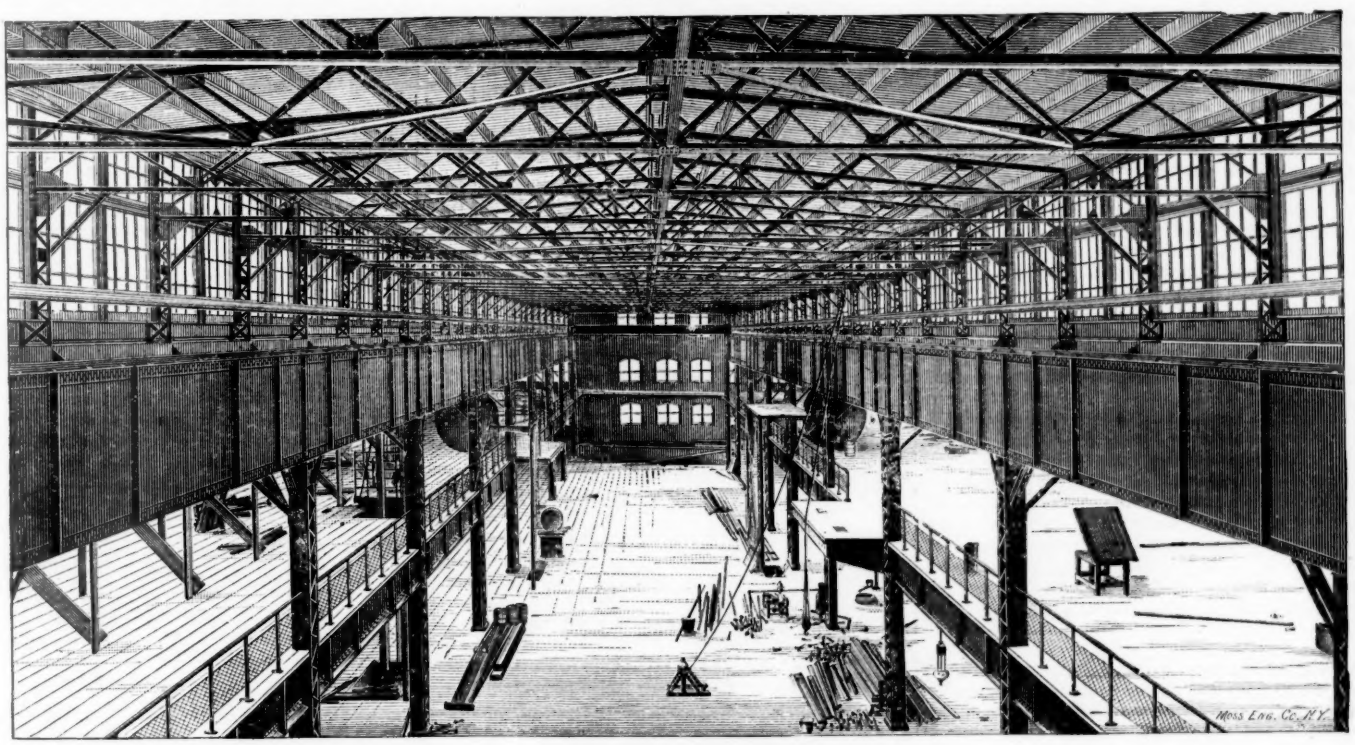
Total time consumed..... Total time consumed.....

INGREDIENTS.	AMOUNTS.			Lot No.
	Pounds.	Gallons.	Barrels.	
150° test				
300° test				
500° test				
600° test (cylinder stock)				
Paraffine				
Well				
Lard (Prime or Ex.)				
Lard (Ex. No. 1)				
Tallow				
Tallow Oil				
Neatsfoot				
Whale				
Horse				
Rapeseed				

After the barrels have been weighed and properly marked they are stored in the shipping end of the "storage shed," and are ready for shipment. No material is shipped out except by order on the Foreman from the Chemical Department, which order is made by that de-



Cross-Section.



Perspective, from a Photograph.

MACHINE SHOP OF THE LINK BELT MACHINERY COMPANY, CHICAGO.

partment to cover the requisitions from the various shops, etc. The order is of the following form:

LEHIGH VALLEY RAILWAY COMPANY.—OIL WORKS.

Order No. .....
Bethlehem, Pa., ... 188..

To Foreman,
Oil Works,
Perth Amboy, N. J.

Please ship as follows:—

SHIP TO.	DESTINATION.	BRAND.	AMOUNT.	
			Pounds.	Gallons.
.....	.....	.....	.....	.....

When this order is received at the works the shipment is made, and the weight of each oil recorded in the shipping book. Shipping notices are then made out in triplicate on the following form:

LEHIGH VALLEY RAILROAD COMPANY.—OIL WORKS

SHIPPING NOTICE. No.....

Order No..... Perth Amboy, N. J.....189..

.....

.....

The following material has been shipped this day

From PERTH AMBOY, N. J.....

per.....

Consigned to.....

.....

No.	Package.	ARTICLES.	AMOUNT.		
			Lbs.	Galls.	Bbls.

One being kept on file at the works, one forwarded to the consignee and the other to the chemical department for entry against the consignee.

Mixed Oils.—The oils mixed at the works, their formulæ, the manner of mixing uses, etc., are as follows:

Locomotive Cylinder Lubricant is a composition of 10 per cent. of the best grade of tallow and 90 per cent. of cylinder stock. Tallow is first melted in the tallow tank, then run into the mixing tank, where it is heated to 140 degrees Fahr., cylinder stock is pumped in from the storage tank and temperature increased to 200 degrees Fahr. The mixture is then agitated for one hour, after which it is pumped up to the supply tank. When the works were first started a much larger percentage of animal matter was used in compounding; it was gradually reduced to the present amount. This combination has been found to give better results, both as regards mileage made and the condition of the cylinders.

Passenger Engine Oil is composed of 30 per cent. of extra No. 1 lard oil and 70 per cent. 25-degrees paraffine. Lard oil is put in the tank first and the paraffine added; it is then heated to 215 degrees Fahr., the mixture is agitated by the blower for 45 minutes, or until cloudiness passes away; it is then pumped up to the supply tanks. It is used on passenger equipment and on fast-running machinery in the shops.

A new mixture, in which 15 per cent. of animal matter and 85 per cent. of a reduced stock base is used, is now being experimented with which promises to give satisfactory results.

Engine Oil is composed of 20 per cent. extra No. 1 lard oil and 80 per cent. of well oil. Lard oil is put in the tank first and the well oil added; it is then heated to 115 degrees Fahr. and blown for 45 minutes, then pumped to supply tanks. It is used on freight engines and for general engine work in the machine shops.

Engine Oil No. 2 is composed of 10 per cent. Extra No. 1 lard oil, and 90 per cent. of well oil. It is mixed in the same manner as engine oil. It is used upon the mine engines and other mining machinery.

Passenger Car Oil is composed of 10 per cent. of whale oil and 90 per cent. of well oil. Whale oil is put in tank first and well oil added; it is then heated to 115 degrees Fahr., and blown for 45 minutes, after which it is pumped to the supply tanks. It is used on passenger equipment for lubricating the journals. A number of tests have been made with this oil in comparison with well-known oils; in each case it has made the best record and has proved a very satisfactory lubricant.

Signal Oil is composed of 30 per cent. of prime lard oil, 40 per cent. of 300 degree oil and 30 per cent. of 150 degree oil. One hundred and fifty degree oil is first put in the tank, 300 degree oil is added and these heated to 110 degrees Fahr., then the lard oil is added and the temperature raised to 120 degrees, at which point it is kept; agitated by the blower for 45 minutes and then pumped up to the supply tanks. This oil is used in switch lamps, hand lanterns, etc.

Navy Signal Oil is composed of 50 per cent. prime lard oil, 40 per cent. 300 degree oil and 10 per cent. of 150 degree oil. It is mixed in the same manner as signal oil It is used on all of the marine equipment for illuminating purposes.

All of these mixtures have been in service for a considerable time and the results obtained from them warrant their continued use by the company.

The Force Employed.—The force employed to operate the works consists of: 1st, a foreman (who also has charge of the Creosoting Co. and the Lumber Yard), whose duties are to look after the general work of the plant, the receiving and shipping of material, and to whom all orders bearing upon the operation of the plant are issued; 2d, a clerk, who has charge of such records as are kept at the works, the making out of shipping notices and of all reports of receipts and shipments which are forwarded to the Chemical Department for entry; 3d, an engineer, also assistant foreman, who has immediate charge of the mixing deparment, the running of its machinery, the carrying out of the formulæ for mixing, etc; 4th, A checker, who has charge of weighing the material received and shipped, making reports of the

same to the clerk, and who looks after the work carried on in the "supply and discharge room;" 5th, a cooper, who attends to the repairing and painting of the barrels, and who has charge of the "tank car discharging house;" 6th, a barrel filler, who attends to the filling, weighing and marking of barrels handled in the "supply and discharge room." All of these mentioned above attend to the general work of the plant, and have been found a sufficient force for the regular work; on extra heavy days, labor is brought in from the Creosoting Company to assist.

The Capacity.—The capacity of the works for mixing oils is about 3,000 gallons per day. The storage of mixed oils, 3,500 gallons in tanks and 10,000 gallons in barrels; for storage of crude stock, 10,000 gallons in tanks and 30,000 gallons in barrels. Additional storage space has recently been provided in which can be placed about 600 barrels.

Methods of Accounting.—At the works records are kept of the amounts of oil received, mixed and shipped. These records are copies of the reports sent to the Chemist, which have already been described. At the Chemical Department the complete records of the oil and waste used on the road are kept. These records consist of: *Oil and Waste Receipts*, in which is given the cost, amount, lot number, etc., of all material received; *Oil and Waste Shipments*, in which is given the cost, amount, lot number, etc., of all material shipped; *Mixed Oil Record*, in which each batch (with ingredient, amount and cost of same) appears as a credit and the the shipments as a debit. By balancing this at the end of each month the amount of oil compounded, amount shipped and balance on hand can be ascertained. *Shop Accounts.*—In this is given the amount of each kind of oil shipped to department ordering. From these accounts a monthly report is made up showing the total amount and cost of each brand of oil shipped to each department. *Bill Book.*—In this is given a record of each charge made against the chemical department. *The Ledger.*—In this is given a summary of all the accounts, and from which the profit and loss account is obtained. Bills are rendered by the department for every shipment made. The prices of the material are fixed so that they will just cover the cost of the oil and cost of operation. Performance sheets are kept by the road, from the summary of which can be seen the mileage made by each division with each brand of lubricating oil.

Financial Results.—A few figures showing the percentage of saving and the relation of the cost to the amount saved by the experiment described in this article may be of some interest to the reader. At the end of the first year of operation, 1889, the percentage saved as compared to the preceding year, 1888, was 40 per cent. At the end of the second year, 1890, the saving effected as compared to 1889 was 14 per cent., compared to 1888 it was 54 per cent. The amounts saved, used in these comparisons, were over and above all operating and construction expenses. The total amount saved at the end of two years of operation bears the same relation to the original cost of the works and laboratory, fully equipped, as does 6.15 to 1.

The financial result, however, is not the only one that has been attained, but what is of quite as much, if not more, importance, the motive power has been better lubricated than ever before, and both valves and cylinders have been in better condition.

Car Oil Box Grinder.

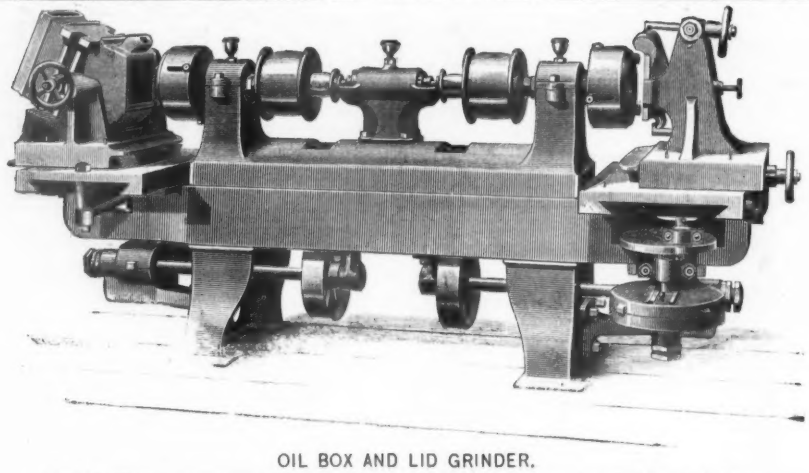
The compact and substantial machine shown here is especially adapted for facing off or finishing, with emery wheel plugs, the surfaces of journal-boxes, etc. The emery wheel chuck contains three emery plugs, which are held tightly against the outside edge of the chuck by means of a cam. The plugs rest against a block which is held by a screw, and can be fed forward as they wear away. Each end of the machine supports a carriage which moves on dovetail ways, gibbed to take up the wear.

A crank-pin and disc fed by a worm and worm gear give a reciprocating motion to the carriage, causing it to move at right angles to the axis of the wheel. The work is held in a chuck which moves in the direction of the axis of the emery wheel on dovetail ways attached to the carriage. The feed towards the wheel is obtained by means of a feed screw actuated by a ratchet wheel and pawl. It can be adjusted to feed at any desired speed, or the pawl can be thrown out and the carriage fed backward or forward by means of the hand-wheel on the end of the feed-screw.

The weight of the machine is 2,065 lbs.: height from floor to centre of spindle, 30 in.; length of bearings, 5 and 3½ in.; diameter of spindle, 1⅝ in.; spindle pulleys, 7½ in.; diameter and length of emery plugs, 1¼ × 3¾ in., floor space, 30 × 73½ in.; driving pulley on countershaft 28 × 8 in.: tight and loose pulley, 10 × 6 in.; length of chuck 4 in., and will take in work 7 × 7 in. These machines are patented, and are manufactured by the Springfield Emery Wheel Manufacturing Company, Bridgeport, Conn.

Smillie's M. C. B. Car Coupler.

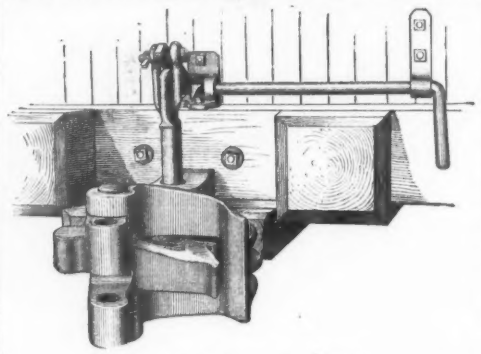
We show in the accompanying illustrations Smillie's "double-lock" car coupler, which has recently been perfected and is now to be put on the market. The coupler has some novel features which are clearly shown in the cuts. It is made on the M. C. B. lines. The knuckle is of cast steel and the draw bar of malleable iron.



OIL BOX AND LID GRINDER.

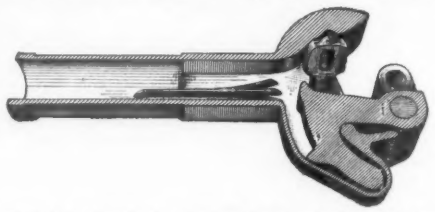
Made by THE SPRINGFIELD EMERY WHEEL MANUFACTURING CO., *Bridgeport, Conn.*

When set to couple, the locking pin is held up by the arm of the S-shaped knuckle, which, when closed, enters the pocket provided for it in the drawhead. In the view of the knuckle will be seen a slight depression on the end of the knuckle arm. This receives the point of the pin and holds the knuckle open until the shank is struck by the



The Smillie M. C. B. Coupler.

engaging coupler. The locking pin must be lifted six inches to unlock, therefore the coupler will not unlock by any jolt of the train in motion. The unlocking device is very simple and well designed. There is the usual lever and shaft, carried in bearings attached to the end of the car, but instead of a chain to lift the pin by there is a clevis, and the locking pin is held up, when the knuckle

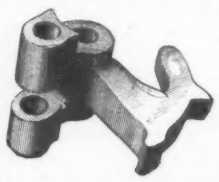


is set not to couple, by means of a step in the shaft-bearing, which supports the lifting arm.

It will be noticed that the eye of the locking pin is formed in a long slot. This is to get a quick drop of the pin. No friction or inertia of the other parts has to be overcome.

Considerable value is attached to the means by which the knuckle when closed engages with the drawhead. This is shown clearly in the longitudinal, horizontal section, and forms the "double lock."

The pulling strain is thus distributed to three points, the pivot-pin, the locking-pin and the S-shaped arm of the knuckle.



If the pivot pin were broken or removed this engagement would be sufficient for all necessary pulling strains as is shown by the following tests made this month by Mr. N. O. Olson, on a Fairbanks testing machine. We quote part of the report. The knuckles were steel from two different makers, the draw heads malleable iron:

"1. Tension, with pivot pins, knuckle breaking at 111,600 lbs.
"2. " " " " " " " " 119,490 "
"3. " without pivot pins, " " " 106,560 "
"4. " with " " drawhead " " 139,640 "
"5. " without " " knuckle " " 135,360 "

"Test No. 3 was with coupling locked without pivot pins and pulled as in service, both knuckles having been used in 1st and 2d tests, broke as above. Test No. 4 was with pivot pins, the drawhead breaking at 139,640 lbs. Test No. 5 was without pivot pins, the knuckle breaking at 135,360 lbs.

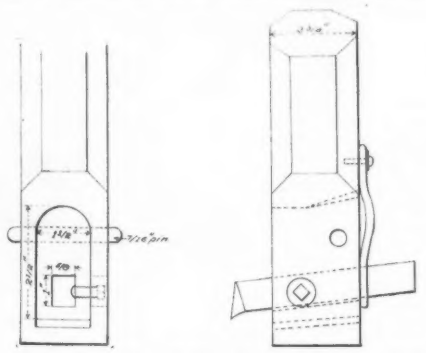
"The tests without pivot pins show that if lugs of drawhead were broken, cars can be moved, knuckles showing very great strength." Mr. Olson writes further: "I have tested all the leading car couplers now in service, and I consider the tests made yesterday on your coupler the best I have made up to date. The last test being made with both pivot pins taken out, strain being entirely on your double lock (knuckle breaking at 135,360 lbs. tension), proves that the peculiar formation of your double lock, knuckle and drawhead is the strongest yet produced."

The double lock was in as good condition after the tests as before.

Shop Notes at St. Paul.

The St. Paul & Duluth shops at Gladstone are about five miles out from St. Paul, on the main line. The shops are not large, but sufficient for the road, and all the repair work is kept well in hand by the heads of the locomotive and car departments. Mr. G. D. Brooke, the Master Mechanic, formerly of the B., C. R. & N., is putting extension front ends on all 48-in. boilers, and expects to try soon some experiments with cast iron stacks. The motive power on this line is in excellent condition, and when an engine comes in for repairs time may be taken to do the work thoroughly, as a number of extra engines were purchased some time since in order to forestall any demand from the operating department.

Some of the tank trucks have the forward truck swung with the hangers forming an acute angle upwards. In rounding a curve the outside end of the bolster should be raised, instead of which, with this design, the outer



hanger swings down and lowers its end of the bolster, while the inside end is raised. This defect is, however, not confined to this make of engines.

Whenever the glands become worn badly, instead of putting in a new brass bushing, the hole is simply filled with babbit metal and the gland bolted on a lathe face-plate and rebored. Hollow stay bolts are not in favor on this line, and the only entrance of air into the fire-box is through the grate.

Many of the older freight cars are equipped with Hill's short swing-link truck. This link is about five in. long, of double-twisted round iron, and is hung below the transom by means of a long U bolt, driven up through the beam, and fastened with nuts on top. These links being short and heavy do not break, and on account of their length only allow the lower swing-hanger pivot to move in a short radius. As will be seen, any slight end motion of the bolster will immediately raise the spring plan k against which is the resistance due to the whole weight of the car. This lifting tendency with the long radius of the ordinary hanger, extending to the top of the transom, is small, and consequently any inequality in the track will throw the bolster over to the arch bar. In many trucks this is from 1½ to 2 in., and the liability of shifting the springs is proportionately great.

The pay-car is having the interior remodeled, and is to be fitted up with a larger state-room, dining-room and kitchen. The observation end has, heretofore, been arranged to allow about one-half of it to be cut off and used as an office, the partitions being made up in sections and readily bolted together in place, so that when the car was not used by the paymaster these could be taken out and left at the shop. Several of the smaller coaches fitted with rattan seats, and used for suburban service, have been changed into combination baggage and smoking cars by tearing out half of the seats and putting up a partition and remodeling the side so as to have a side door instead of windows. This has been done to meet an immediate need, as the road was unable to obtain cars from the builders in the time they wished.

In the matter of small attachments to shop tools for

accomplishing special objects there is quite a field in which a man in charge of the tool-room may display his ingenuity, and frequently he has a decided advantage over the makers in that by being around the shops he meet the difficulties to be overcome, and is compelled from circumstances to make some shift or other to gain his ends. Although these little changes may seem of small moment when taken separately still in the aggregate they count for a good deal, and an intelligent machinist may save in this way a considerable sum in the course of a year.

A device for relieving the cutting edge of the tool in a slotter and preventing it becoming dulled by rubbing against the work on the return stroke, in use at these shops, is shown by the sketch herewith. The slotting-bar is made from 2⅝ in. square steel, chamfered at the corners on the upper part so as to form a regular octagon, to allow cutting into corners of the work by turning the bar in the holder. The lower end of the bar is slotted for the tool-block, 1½ in. by 2½ in. The block, being somewhat smaller than the pocket, allows a little play when swinging on the $\frac{7}{16}$-in. pin. The side of the bar is drilled for using a socket wrench on the set screw for the tool, and the spring at the back is simply a small steel wire doubled over a set screw, and bent so as to relieve it from the block except just at the point, thus insuring a full return of the tool block to its proper place. With this holder the only wear of the tool edge, from rubbing on the return stroke, is that due to the pressure of the wire spring.

The Serve Ribbed Boiler Tube.

A special exhibition test of the Serve ribbed boiler tube has been going on for the last 10 days at Elizabethport, N. J. The object of the test is a comparison of efficiencies between it and the plain tube of present use.

The boiler in use for test purposes is of the vertical type, 42 in. in diameter and 9 ft. 6 in. in height. It is supplied with a furnace 36 in. in diameter, sixty-three 2½-in. tubes and a 15-in. uptake. It was first supplied with a set of plain tubes, and its efficiency as a water evaporator ascertained; the plain tubes were then removed, a set of sixty-three 2½-in. ribbed tubes inserted, and its efficiency as a water evaporator ascertained after the change. The ribbed tubes have about double the heat-receiving surface exposed to the flame that the plain tubes have, while both have the same outside heat distributing surface. The results of the experiments have not as yet been figured out. We hope to present a full report as soon as they have been ascertained.

A test of these tubes reported by Messrs. John Brown & Co., of Sheffield, give the economy of the ribbed tube

over the plain tube at 12½ per cent. A French Admiralty test gave, with natural draft, 15 per cent., and with forced draft, 20 per cent., economy in favor of the ribbed tubes. On the steamer "Le Bourbon," of the Compagnie Général de Navigation, Lyons, France, a saving of 24 per cent. in coal is reported. This latter company has placed the tubes on eight additional steamers as a result of the "Le Bourbon" test. The French navy is reported as having made a trial of the ribbed tubes, and as having found them perfectly satisfactory. The tubes have been applied to other steamers on passenger lines with promising success.

The Paris, Lyons & Mediterranean Railroad Co., after a trial of two years, has adopted the tubes for general use, and is now refitting 40 locomotives with them.

A peculiar and pointed test has been made by the manufacturers, with the following result, as quoted from their own report: "We have proved beyond all question that the ribs in the Serve's tube never become 'red hot,' and we have proved it in the following manner: To test this point the manufacturers covered a steel tube, inside and outside, with an alloy of tin and antimony. They then surrounded this tube with a larger plain one, allowing but ⅜-in. water space between the two. A strong blast was kept going an entire day through the ribbed tube horizontally, the flame jet projecting 3 ft. beyond the ends. Upon examination after the experiment, it was found that the heat had made no impression on the alloy, the melting point of which is far below the degree of heat necessary to produce a visible red on iron or steel."

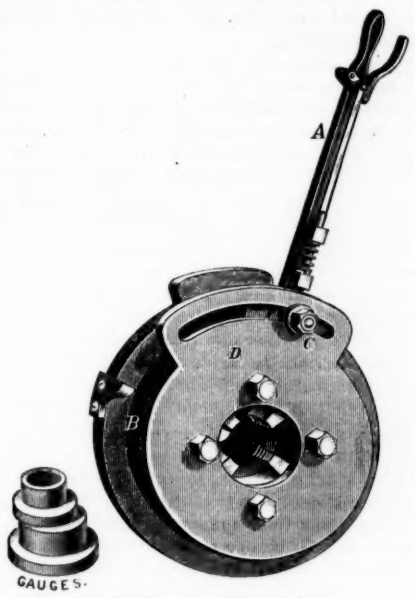
Thread-Cutting Machine and Die.

We give herewith illustrations of an adjustable expanding die provided with interchangeable chasers, also of a special power and hand operating machine for threading or cutting piping of the various sizes, both of which are manufactured by Messrs. D. Saunders' Sons, of Yonkers, N Y.

The cutting head of the machine is made to receive either the expanding die or an ordinary solid die, and the expanding die is of such construction that it can be applied to any of the ordinary pipe-threading machines.

The expanding dies are provided with a number of sets of chasers to suit the different sizes of pipes. The head is adjustable and expanding, and will cut a thread with a single passing over. When the desired length of thread is reached, the cutters or chasers are opened by a movement of the hand lever, and the pipe is released without stopping or reversing the machine. But little time is occupied in withdrawing one set and inserting a second set of the chasers; the adjustment to size is readily effected.

The thread dies do not require to be removed from

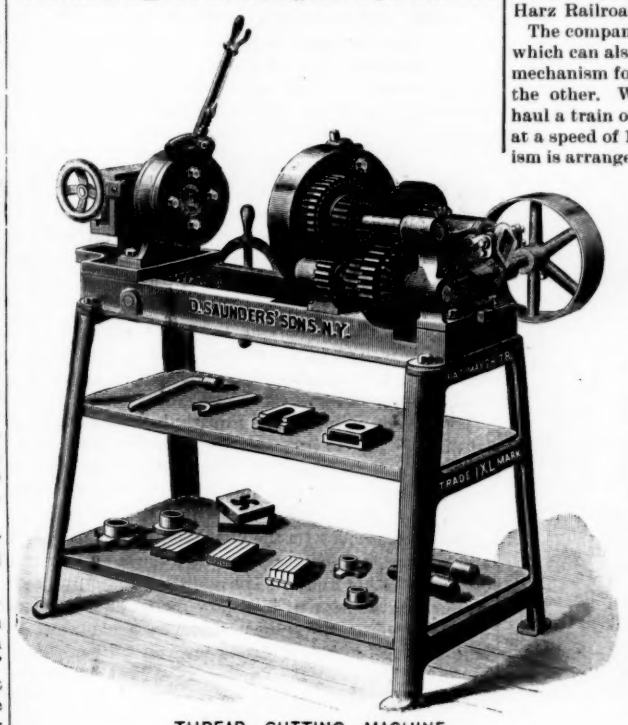


Die for Saunders' Thread Cutter.

their place while the cutting goes on, as they can be spread to allow the pipe to pass through into the guide in the cutting-off head of the machine.

The chasers can be sharpened after the usual manner, and when worn they can be recut again.

The gripping chuck is substantial and strong, the chuck on the back end of spindle for centering the pipe is self-centering, and the cutting head is provided with



THREAD CUTTING MACHINE.

Made by Messrs. D. SAUNDERS' SONS, *Yonkers, N. Y.*

a slide and cutting tool, and with self-centering jaws to steady the pipe while being cut off.

The carriage is moved by a rack and pinion and operating handwheel. When power is used a pulley is attached, as shown in the cut.

The machine is adapted to cutting off round iron or steel, and can be fitted with taps and dies for tapping, threading and cutting nuts and bolts. All the parts and dies are fitted to steel gauges, to provide for their renewal or duplication.

The Railroad from Visp to Zermatt—Adhesion and Rack.

The valley of Zermatt, Canton of Valais, Switzerland, is more and more frequented by tourists, but the ascent of the valley has until the present been tedious and difficult, the distance between Visp and Zermatt being about 26 miles and the roads bad and rough. The franchise for this railroad was granted to Messrs. Masson, Chavannes & Co., bankers at Lausanne, and the Commercial Bank at Bale in 1886. A company was organized with a capital of $500,000, the balance of the funds necessary for the construction of the road to be raised by the issue of bonds. Several rontes were examined with and without the use of a rack. The estimated cost was $1,170,000, or about $46,800 per mile.

In 1888 propositions were made by Engineers Chappuis and Stockalper for the construction of the road, which propositions contained a modification of the plans-making a more extended use of the rack system, and which at the same time would make a saving in cost of construction of about $90,000, and a contract was signed with them.

The line, one metre gauge, starts from Visp, a station on the Jura-Simplon Railroad, at an altitude of 653.55 metres. A curve of 196.8 ft. radius brings the line to the right bank of the Visp River, which it skirts till it reaches 6.2 kilometres, the grades being relatively slight, never exceeding 90 ft. to the mile. Thus far the road presents no difficulties. At 6.25 kilometres the Visp is crossed on a metallic skew bridge, 35 metres span. The first rack section, 964.71 metres long, with a grade of 633 to 660 ft. to the mile, begins at 6,358 kilometres, and extends to the station of Stalden—altitude, 802.68 metres. Just beyond is another rack section—grade 660 and 633 ft. to the mile—954 metres long. At 8,312 kilometres, at an altitude of 900 metres, a level 3,356 metres long is reached. On this section are several deep cuts and many tunnels. At 8,980 kilometres the Muhlbach ravine is crossed by a viaduct, a metallic arch, 54 metres span and 50 metres high. The level terminates at 11,633 kilometres, and is followed by grades of 78 to 130 ft. to the mile. At 12,150 kilometres the Visp is again crossed by a metallic bridge, 27.5 metres span, and at 12,349 kilometres a rack section, 2,327 metres long, begins, with a maximum rise of 633 ft. to the mile. Between this point and Zermatt the road presents few difficulties. There are several rack sections and a number of viaducts, the grade never exceeding 528 ft. to the mile.

In the construction of the road most of the retaining walls were laid up dry. When, however, their height exceeded 16 ft., or if their bases were exposed to water, they were laid in mortar. A steel Vignole rail, weighing 48 lbs. per yard, is used. Each rail rests on 13 metallic ties; the joints are suspended. The ties are of soft steel and weigh about 83 lbs. each.

The rack used is the Abt system. The construction and arrangement are similar to that adopted for the Harz Railroad.

The company has four locomotives of the Abt system, which can also be used on the adhesion sections. The mechanism for each system is entirely independent of the other. Working by adhesion, the locomotives can haul a train of 75 tons, on a grade of 156 ft. to the mile, at a speed of 18 to 20 miles an hour. The rack mechanism is arranged between the driving axles, and is driven by a second pair of cylinders. Each rack axle carries two pinions, which are not keyed solidly to the axles, but are secured by springs, so as to allow for any inequalities in the rack. The teeth of the pinions are stepped, the tooth of one pinion coming exactly opposite the opening of the other. The pinions of the two axles are so secured that four teeth are engaged and working simultaneously, so that the movement is smooth and the security great.

The locomotives are worked continuously by adhesion over the whole length of the road, and the rack mechanism is used for climbing the grades when the adhesion would not be sufficient.

Each locomotive, for security, is provided with four separate brakes; first, the ordinary hand brake; second, the steam cylinders are utilized during a descent by shutting the throttle, reversing the link motion and pumping in air, when the pressure and consequently the speed is regulated by means of a cock regulated by the engineer. The cylinders driving the rack mechanism are used for a similar purpose, and lastly a powerful strap brake acting on the four disks placed at the side of the rack pinions. More than this, the locomotives are provided with the necessary apparatus for operating a vacuum brake, Hardy-Smith system, with which all the passenger and freight cars are fitted.

The passenger and freight cars are of the American type, with central aisles, and rest on four-wheel bogie trucks. The road is in use from June 1 to Sept. 30. The fare for the whole trip is $3.20 second class and $2 third class. No first class.

An Electric Railroad at Niagara.

The Ontario Legislature has granted a charter to a company to build an electric railroad from Niagara to Fort Erie, the whole length of the Niagara river.

Canada's Public Works.

The report of the Dominion Minister of Public Works for the fiscal year, has just been issued. The total expenditure of the department on public buildings, harbors and river improvements, roads and bridges, etc., was as follows: Construction and maintenance, $4,839,103; repairs, $290,080; staff and maintenance, $534,714; a total of $5,617,897. There has been expended during the year on construction, repairs and improvements the sum of $322,900. To this may be added $2,725,504, being the expenditures on the ship channel of the St. Lawrence between Montreal and Quebec assumed by the Dominion.

RAILROAD GAZETTE

Published Every Friday,
At 73 Broadway, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

There was published in the *Railroad Gazette* of March 20, a study of the New York rapid transit problem, by Mr. Theodore Cooper. To-day we publish one by Mr. W. H. White, considerably more detailed. The two writers, following entirely different methods of investigation, come to the same general conclusion, viz., that the franchise for building and operating a new rapid transit line in New York is not a very marketable commodity. After a pretty thorough analysis of the probable traffic and income Mr. Cooper concluded that unless capitalists choose to build and operate a rapid transit system for New York on a philanthropic basis it must have public aid of some sort, or public opinion must permit the extension and increase of the elevated railroad system. Mr. White's analysis of the cost of construction is more detailed, and his analysis of income less so; but he comes to the same conclusion as Mr. Cooper "that the franchise . . . in competition with the present elevated system, is one requiring subsidy, and not one for which capitalists will not pay." He suggests a limited guarantee of interest and release from taxation. Another essential is such security of right of way as will forever save the property from the menace which hangs over the elevated roads of New York now. Their present danger is not so much that their value will be destroyed by competitors as that it will be swallowed up in property damages. No new enterprise ought to be floated, or is it likely to be, unless its right of way can be made safe from damage suits. Further, it goes without saying, that there can be no successful system operated by the city, or in the operation of which the city has any more voice or control than it has now in the affairs of the elevated roads. A rapid transit system operated by New York City officials would be a public calamity.

In this issue is published the conclusion of Mr. Coleman's account of the experiment of the Lehigh Valley Railroad in mixing its own oils. The description of the plant and of the whole method of operation is very thorough, but the significant part of it is found in the last paragraph. The saving at the end of the first year was 40 per cent., and the second year 14 per cent. The saving in two years was over six times the cost of the whole plant and laboratory. We have heard of one road that saved $100,000 in one year with a plant that cost about $10,000, but this we do not swear to. Another road saved $50,000 the first year of the operation of a $20,000 plant. If such things are possible, why do not all railroads mix their own oils? There is one general reason which will occur to every one, but, of course, there are special reasons in special cases. The general reason is that it is not for the interest of the oil companies and their connections that they should. The profits are too great. Therefore the idea is cultivated that great skill and experience and costly plant are required to mix oils successfully. It is for this reason that we have been especially pleased to give the detailed account which Mr. Colman has prepared, for it points the way to a very important economy. The railroads of the United States probably spend about $5,000,000 a year for oil for lubrication and lighting. If half of this could be saved it would be a substantial public gain, and a substantial loss of profit to some one. At any rate the matter is worth investigating.

The drawbridge accident reported on another page was similar to that at Oakland, Cal., a year ago, except that in this case no one was killed or injured. There are, however, three points worthy of mention in the Port Richmond case. First, the engineman was intending to resign within a day or two to take a better job. No one can assert that the unusual matters on his mind exerted an undue pressure to drive out thoughts of his immediate duty, but cases like this and like that of the English runner, not long ago, who was worrying about a sick wife at home when he let his train run away, inevitably raise the question, How can runners with preoccupied minds be made to lie off? This is an obscure and ineradicable difficulty, but it is by no means certain that nothing can be done to mitigate it. Trainmasters who habitually permit men to work excessive hours when there is a rush of freight are responsible for *not* mitigating this evil, for their practice directly encourages men to take the risk of going upon an engine when their minds are unfit for work. A derailing switch is one radical cure for absent-mindedness. Second, the fireman was a temporary one, taken from the shop, and had not been examined. Examination rules must be rigid or the single dropped stitch will turn out to be the most important in the whole chain. Third, the drawbridge exists for the sole benefit of a single lumber yard. Drawbridges that are opened every day cause blasphemy enough, for the cases in which a scow-full of garbage hinders a thousand passengers are increasingly common; but here is a case where hundreds or thousands of passengers must daily ride over a specially dangerous spot because a boatman wishes to go through once or twice a week. Quite likely the infrequency of the danger signal at this point was a factor in the runner's failure to observe it, but that only further illustrates the unnecessary burden placed upon a railroad by the multiplication of danger points.

Some of the Troubles with Steel Castings.

The causes of blowholes in steel castings are evidently numerous, if we are to believe all that is said about them. So far, the list is about as follows: (a) Piping action; that is, a shrinkage of the metal in cooling which causes it to be porous in the vicinity of the riser and in other thick places. (b) Gases given off by the cores. (c) Gases in the steel itself. (d) Atmospheric air carried in by the liquid steel during pouring.

To prevent piping, cores properly located seem to be adequate. The location of the gate has much to do with it. Castings which are otherwise the same will be found porous in one cast and solid in another, where the location of the gate is different.

The main remedy for the blowholes due to gases and atmospheric air seems to be lowering the melting point, or the use of hot molds. The addition of aluminum to reduce the melting point is, owing to its low price, now being made the subject of extensive experiment, both here and in England. Some railroad companies in England, notably the Lancashire & Yorkshire, have been very successful in making steel guide yokes, truck wheels and driving wheels by the use of a "physic," as it is called, principally of aluminum. At the present time two scientific societies in England are investigating this matter. Lowering the melting point has the effect of allowing the steel to remain fluid a sufficient time to enable the gases given off by the cores, or which may be in the steel, or the atmospheric air that may be carried into the mold by the liquid steel, to escape through the vents provided. Much success has been attained in keeping the steel in a fluid state while in the mold by using iron or steel molds coated with a thin layer of separating material, and cores as much as possible of iron, all of which are heated as high as practicable before the steel is poured.

It is evident from the progress recently made, and from the success already attained by some steel-casting companies in this country, that they will soon be able to produce sound steel castings of any form. In fact there is little excuse now for steel castings so porous as to be objectionable for ordinary work. Of course, for receptacles to be kept tight under a heavy pressure, the small blowholes, which are at present almost unavoidable, will be found to be seriously objectionable; but so far as strength is concerned, these small blowholes matter but little. Stationary-engine companies and makers of mining machinery are using large quantities of cast steel with numerous fine blowholes, and in their experience there seems to be no objection to such castings. In fact it has been stated by them that even with a considerable porosity the castings of steel are more satisfactory and reliable than those of iron.

The cost of cast steel is lower than most people think. For instance, the large rolling-mills make their own steel casting from the blooms from which they roll rolls, plates and beams, etc., and charge them up on their books at only two cents per pound, but such castings are large and rough. English railroads have found that for equal strength cast steel is cheaper than cast iron. The cost of melting steel is but little, if any, greater than melting cast iron when one is familiar with it. The possibilities in this way are well illustrated by a brake-shoe company in Chicago, which has recently put in a steel-casting plant for brake shoes. They are now making their own cast steel without the least difficulty, and they get a more uniform product than they have been able to buy in the past. There are as many grades of cast steel as of cast iron, and, just as some foundries make good cast iron while others make only an inferior casting, so some cast-steel makers are sending out cast steel which is not as good as first-class cylinder iron, while others are making a very good product. There is a knack in this business, as in every other; but the demand for cast steel is such, both here and abroad, as to make the subject interesting to scientific investigators, and we may hope to learn within a year or two of rapid improvements in the processes for making cheap steel castings.

Some Consideration of Electric Motors for Railroad Use.

II.

On the lines laid down in the article published last week, the efficiency of any given motor doing any desired work can readily be determined. First, it is necessary to determine the highest speed at which the motor will be called upon to do any considerable work. This with a given motor and constant amount of wiring used will be the point of maximum efficiency. To make this efficiency as great as 90 per cent. requires a large motor in proportion to the work to be done; 80 per cent. is as high efficiency as can be reached at speed in train service without employing larger motors than are really practicable at the present time. Hence, when a train is running at its maximum speed the efficiency of an electric motor driving such a train may safely be taken at 80 per cent.

If a train should start at New York and run to California without stopping, on a comparatively level road, the efficiency of the entire operation might be 80 per cent., as the inefficiency at starting would be lost in the long-time run at a high efficiency. But railroad work is performed in a different way. Take, as an extreme case—but one for which the electric motor is often suggested—the suburban service in our great cities, either elevated or surface. The train operation is something like this: A train starts from a station, pulls out as hard as possible, reaches maximum speed, shuts off power, runs along for a short distance, and the brakes are applied. Power is used only during the accelerating or "getting underway" period. During this time the efficiency of a steam locomotive varies about 25 per cent., while that of a series electric motor varies from zero to 80 per cent. of its capacity. The average efficiency during the whole distance between stations then would be but 40 per cent. at the best. If, however, there is any delay at starting with the electric locomotive, as there often is with the steam locomotive, then there will be a considerable further loss, which will reduce the average efficiency below 40 per cent. A steam locomotive may pull for hours on a train without starting it, and yet use little or no steam, and hence suffer but little from loss of average efficiency.

There is still another point which should not pass unnoticed. The decreased power which accompanies the higher efficiencies and speeds may be too small to accelerate the train with sufficient rapidity after the train has already reached considerable speed. This is more than likely to be true in suburban service, and can readily be determined from a time schedule, knowing the distance between stations. If it be true that the pull of the motor, when running at 80 per cent. efficiency is too small, then the maximum efficiency during the period of acceleration must be dropped, say to 60 per cent. This gives an average efficiency of 30 per cent. provided no considerable time is lost in getting started.

Now, from this it appears that while it is beyond dispute that electric motors can be made to run at 90 per

cent. efficiency, yet in certain classes of train service owing to the nature of the service, this efficiency can not be attained on the average because the work of the motor consists of a series of starts from a standstill and the performance of considerable work at a comparatively high and increasing speed.

The foregoing represents one cycle of action of a series motor from rest to maximum speed of armature. As shown, the efficiency varies from zero to a maximum depending upon the size of the motor in proportion to the speed and power required. If, when the first motor has reached the point of increase in speed and decrease of pull on train where it can no longer furnish sufficient pull for still greater speeds, another motor, the same in all respects except the winding, be switched into circuit, it being adapted to pull harder at the higher velocities, then the speed might go on increasing, but the efficiency with the second motor would be less than that with the first when it was cut out. The same effect is produced if the winding is changed on the first motor; that is, if some of the wire on the field is cut out of circuit. This last is perfectly feasible, and is the plan proposed by those who have given this matter the most attention.

The favored plan, then, seems to be to use a motor that starts from rest, when the train starts, and runs at increasing speed until the power is cut down by its own counter-current to a point where it can no longer furnish sufficient torque to accelerate the train, then some of the wire on the field magnets is cut out of circuit, and the efficiency drops and the torque increases again. Therefore the motor now thought best fitted for suburban train work is one which commences with a zero efficiency and maximum pull on train, and then works with increasing efficiency and decreased torque until it will no longer accelerate the train with sufficient rapidity. Then the increased efficiency is lowered greatly and the torque is increased and this changed motor works up to a reduced torque and increased efficiency as before, and again the motor is changed in its effective wiring and its torque increased. So on, this may be continued, until the desired speed is reached, The curve of efficiency of a motor thus operated with reference to change in speed resembles the teeth of a saw—there is a rise of efficiency from say zero to 60 per cent., then a drop to 20 per cent., then a rise from 20 per cent. to 60 per cent. again, then a drop to 20 per cent. and so on until the desired speed is reached. The curve of the torque with reference to the speed commences at a maximum and drops to a minimum at 60 per cent. efficiency. It rises again when the efficiency is made 20 per cent., and so on, its outline being quite the same as that of the curve of efficiency, but with opposite phases. The conclusions then are:

(*a*) The series motor is considered as best adapted for train work where there are frequent stops to be made.

(*b*) Series motors can be built for a high efficiency for a constant or nearly constant speed, but the efficiency under the conditions of suburban train service is a variable quantity, having a minimum at zero, and a maximum at the point where its pulling power is reduced to be just insufficient to further accelerate the speed of the train.

(*c*) With a given time-table, location of stations and train weight, a motor may be built which will make the time and haul the trains, but its efficiency in operation is dependent, not upon its intrinsic construction, but upon the time-table and distance between stations.

(*d*) There is no easily determined and general efficiency of electric motors in train service; each condition to be met imposes its own efficiency, and in general the efficiency for suburban work is much lower than where there are long runs at a comparatively constant speed.

(*e*) In the coal used for an electric system there may be a money saving over the coal used for a locomotive, as the price of these two fuels may vary greatly; but in the steam used, the steam locomotive will be more economical than the electric system, where trains are frequently started from a standstill, even when all reasonable allowance is made for the difference in the efficiencies of locomotive and stationary engines and boilers.

The functions of distant and home signals, respectively, were concisely stated the other day by one of our best signal engineers as follows: "The distant signal (when on) tells the engineman that he *must* stop, and the home signal (when on) tells him *where* he must stop." The corollary of this statement would be that the distant signal, when off, tells the engineman that he may proceed at full speed, and the home signal, when off, tells him—the same thing. And as the runner knows that the clear position of the distant signal is an almost infallible warrant that the home signal will be found in the same position, we at once see that there is here a powerful influence tending to make the engineman careless about observing the second signal. From long habit he very naturally comes to regard this second indication as merely an unnecessary adjunct to the first one. The most plausible theory of Engineer Fowler's mistake in the Fourth Avenue tunnel, Feb. 20, is based on this principle. This illustrates one of the merits of the system of putting the distant signal on the same post with a home signal, as is done with the Union Switch and Signal Company's electro-pneumatic block system. This calls the runner's attention to whichever signal he may be most likely, from his habit, to regard as of secondary importance. It is perhaps a fortunate thing for the railroads and for the art of block signaling in this country that the track-circuit system has, by its limitations, helped to establish the practice of making short block sections. The universal use of short block sections is, however, out of the question, and the theory of distant signal location as employed in the pneumatic cannot be stretched so as to make it applicable everywhere; but its value is worth considering wherever practicable. In fact, English practice of long standing confirms this assertion, though distant signals over there are customarily so far from their home signals that signal engineers have probably two chances where Americans have one of placing a distant signal on a home-signal post. The primary consideration in locating a caution signal is the distance required in which to stop a train, but as this distance cannot be fixed by precise rules engineers are not agreed on the point, and practice is not uniform. It is therefore well to bear in mind that the caution signal should not be placed farther off than is necessary for a good stop, unless careful provision is made to keep the discipline of runners constantly effective. If a runner shuts off steam on passing a horizontal green semaphore, and then has to put it on again to reach the home signal, or, if he habitually find it necessary to use steam for some distance (after passing such a caution signal) before preparing to obey the home signal, there is a chance that he may forget what the signal has told him, and this chance must not be ignored.

At Shipton, England, in 1874, a train accident caused the death of 34 passengers, and Charles Francis Adams, has, by the description of it in his book, made the name one suggestive of horror. Last Saturday a collision on the Lake Shore & Michigan Southern, reported in another column, gave a similar significance to the name of Kipton. The prevention of such a blunder as that which killed the six mail clerks and the two men who were probably the most immediately to blame, is a problem. It will doubtless be claimed in some quarters that it is beyond the power of the Superintendent or Train Master to further promote safety by mere discipline, and that a double track is the only practicable means of making a road like the Lake Shore safer at such a place as Kipton; but it is a fact that there are yet large possibilities open to most managers before they come to such a serious financial question as that involved in laying hundreds of miles of second track. As the two enginemen are dead and the precise state of the discipline of the road is not known, nothing can be said as to the particular processes by which they miscalculated; but as train 21 was due only three minutes before train 14, we must assume that there was no clearance time allowed by the general rules and that, this being the case, the standard code was in use. The standard code, however, plainly places responsibility on both trains, as will be seen by a careful perusal of rule 93*; so that if the circumstances are as stated, it is not easy to see how the men of train 21 can be the only ones to blame, and further light should be thrown upon the statement as published. This may be one of those cases where the conductor can hardly be expected to discover an engineman's miscalculation promptly enough to avert evil consequences, but as matters now look, the conductors ought to be made to throw some light upon that much neglected rule, No. 120. If, indeed, train 21 was inferior to 14 it may well be asked why a block system, against both rear and butting collisions, was not in use. A road whose business is important enough to warrant two classes of fast trains is bound to provide the very best safeguards. The "average road" operating single track may have some ground for spending its money in other directions than for block systems and distant signals, but one with a track suitable for running trains like the Lake Shore limited and fast mail trains, is not in that class. A distant switch signal does not wholly "fill the bill" in a case like this, for the inferior train needs protection (if it needs it at all) before its brakeman can set the signal; but a block system is not only feasible but simple.

NEW PUBLICATIONS.

A Descriptive Treatise on Constructive Steam Engineering; Embracing Engines, Pumps and Boilers, and their accessories and Appendages. By Jay M. Whitham, M. E., C. E. New York: John Wiley & Sons, 1891. 8vo, pp. 900; illustrated; index. Price $10.

This work is a valuable contribution to technical literature, because it concentrates under a single cover information regarding the construction and application of steam engines and boilers, and their accessory devices, which is always more or less in demand by all who are concerned in the use of steam, but which has hitherto been available only by consultation of many different journals, technical treatises or manufacturers' catalogues. We find in this one work, clearly illustrated and briefly but comprehensively described, not only a great variety of marine and stationary engines, but most of their parts and appendages. There are also directions and forms for boiler and engine tests; standard boiler settings and fronts; calculations of power from indicator cards; rules for proportions of belting; rules for strength and capacity of boilers; descriptions of the method of working the different qualities of boiler iron, etc., etc. All of these things are well known, but nevertheless so often need to be "looked up" that a common repository for them, compiled by a writer of good practical experience and who is an industrious student, should become a popular ready-reference book.

Most of the illustrations are identical with those of manufacturers' circulars, and considerable text is quoted from the same source. No one should discount the work, however, because of these facts, for the modern trade circular must be regarded as ranking in many instances among the best practical technical literature, especially as regards illustrations, and Professor Whitham, in selecting among the almost unlimited abundance of material which the field affords, has exercised excellent discrimination in his choice of matter.

Our criticisms on the book are, with possibly one exception, merely in the line of suggestions regarding extensions or additions. Thus, in the chapter on "Heat and Steam," the latest Barrus calorimeter, known as the "Universal Type," should be mentioned, as it is of more importance and more successful than any other form of these instruments. In the same chapter the table of non-conductors of heat given is quite inferior in reliability and scientific value to that resulting from the experiments of Ordway, whose enunciation of the law governing the influence of air, more or less thoroughly confined, is a very important contribution to this subject. The exposition of the Corliss system of cylinder and valve construction, while a welcome extension of the meager literature of this subject, needs to be completed by plates, showing the exact proportions or dimensions of one of the standard forms of this type of releasing gear, such as is given, for example, in the case of the Stephenson link motion.

The foundations of engines is a subject which will be looked for by all students of the steam engine, but it is a disappointment to find that this book confines its remarks under this head to deciding that brick is the best material to use, and to directions for mixing the proper cement. What is wanted is a discussion of the necessary *dimensions* of foundations, with some good examples illustrating good and bad foundations respectively.

The treatment of the subject of indicators, including examples of good and bad cards, and methods of computing horse power, compares favorably with any previous attempt, but, in handling the matter of the estimation of the steam and water consumption from the card, two errors are committed: 1st. The reasons why the steam per hour per horse power is independent of either the mensions or speed of the engine are not given, the whole matter being made to depend blindly on a table taken from an engine circular. 2d. No data are given by means of which the discrepancy between the steam calculated and that which will probably be actually consumed can be determined. On both points the author could not do better than embody the matter given in the Tabor Steam Engine Indicator Book, by G. H. Barrus, a most lucid and comprehensive little treatise, too little known or appreciated by engineering readers.

In the chapter on valve motions, we have an excellent exposition of the use of the Zeuner diagram, by the aid of numerical examples, but nothing is given to impress upon the student the important fact that, after any such general method as Zeuner's has decided upon the *outline* proportions, the *exact* proportions of any practical valve gear, such as the Stephenson link, or common Corliss motion, can only be determined by a careful process of trial and error approximations on the draughting board. What is wanted to clearly exhibit this fact, is that the author should start with Zeuner's diagram, and, after using it as far as possible, to determine the dimensions of the standard link motion of a modern locomotive, go through the "trial and error" adjustments necessary to finally arrive at the adopted proportions. Students of valve gearing are too much taught to believe that by some such method as Zeuner's or Bilgram's it is possible to completely and definitely determine every detail of valve motions; whereas the fact is, that all these methods are only capable of determining *general* proportions.

In the chapters on high speed engines, and their governors, we miss the clever and potent device of the dash pot, in the case of the Ball engine governor; also any mention of the interesting mechanical reason for the use of single acting cylinders in the Westinghouse engine; and the ingenious principle in the same machines compounded, whereby the steam is constantly cushioned through about the same range, at all cut-offs. Of a similar nature is the absence of any attempt at explanation of the paradoxical action of the Westinghouse "Steam Loop," which is just now exciting the attention of steam

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* All trains must *stop* at schedule meeting or passing points on single track, if the train to be met or passed is of the same class, unless the switches are plainly seen to be right and the track clear. The point at which a train should *stop* is the switch used by the train to be met or passed in going on the siding. When the expected train of the same class is not found at the schedule meeting or passing point, the train having right of track must approach all sidings prepared to stop, until the expected train is met or passed.

users. (See the *Railroad Gazette*, April 3.) A word in explanation of its probable cause of action, similar to that given in the case of the injector, should have been a part of the author's mission.

In touching the elusive question of the horse power of boilers, the author relies too much on his quotation from another publication, and thereby fails to bring his facts down to present date. Marine boilers are constantly and reliably quoted as producing a horse power with less than 3 sq. ft. of heating surface, and yet in the table, page 783, no tubular boiler is allotted less than 10 sq. ft. of heating surface per horse power. The discrepancy here noted is due to the fact that the table is a copy of one handed down from book to book for the last 20 years, and takes no cognizance of the fact that multiple cylinder engines have reduced the steam consumption per horse power from 30 to 15 lbs., per hour, and that forced draught has made it easily possible to evaporate 6 lbs. of dry steam per hour per square foot of heating surface. No summary of boiler power ratings, based on heating surface, can be comprehensive which does not consider rates of combustion as well as engine steam consumption.

In the treatment of boilers, we are glad to see so many extracts made from that admirable little organ of the Hartford Steam Boiler Insurance Co., *The Locomotive*, edited with so much care and talent by the President of this organization. This publication is a rich mine of valuable material on all matters relating to boilers, and, taken as a whole, is the best treatise on the subject of their management extant. It is remarkable that writers on boilers have not drawn more from this source. The varieties of boiler types should include the Herschoff, Thorney, Croft and Yarrow styles to be thoroughly up to date.

The single exception, to which we have referred above, is in relation to the author's discussion of power, etc., of compound engines. He here gives vent to ideas which are presumably original with himself, and which, while possibly incapable of much harm, are nevertheless quite an unnecessary complication of the subject. We refer to the statement, page 375.

"In calculating the indicated horse power for a compound engine, the common practice is to take for factors the area of each piston and the (mean) indicated pressure upon it per square inch as given by the indicator diagrams from the respective cylinders. Thus the indicated horse power is obtained for each cylinder, and their sum is the indicated horse power developed by the engine. In fact however, the indicated horse powers developed by the engine *are not thus distributed*, although their aggregate is correct. . . . The true indicated power developed in the large cylinder is represented by the indicated pressure there, multiplied by the area of the *ring* remaining after subtracting the piston area of the small cylinder from the piston area of the large cylinder. . . . The foregoing principles governing the compound engine suffer no modification by any variation of the relative position of the cylinders or addition of parts, or by the interposition of a receiver, etc."

We doubt if the author will ever convert a sufficient number of readers to these peculiar, if not erroneous, views to compensate for the confusion they introduce. When both the high and low pistons are attached to the same piston rod it is necessary to subtract the high piston from the area of the low to determine the *thrust* on the crank pin. But there is no error in computing the horse power of each cylinder from each card into its own piston. In the method of combining the cards of a compound engine, set forth on page 379, there should be directions regarding the disposition of clearance. The peculiarity of augmenting the back pressure of the low cylinder by the amount of loss of pressure between the high and low cylinders seems an unnecessary distortion of the real facts.

The discussion regarding tandem (meaning Wolff type) *versus* receiver compound engines, page 381, which holds out the idea that the Wolff type of compound may, under certain conditions, be superior to the receiver form, is misleading, in view of the fact that the latter form of engine has, all over the world, been *found* to be most economical.

We beg to call Prof. Whitham's attention to the fact that the combined diagram of the Gaskill engine, page 178 (evidently copied from some other publication), violates the rule he lays down for combining, page 379, in that the total base line represents the sum of the volumes of both cylinders instead of that of the low cylinder alone. We think the whole treatment of compound engines not at all up to the standard of excellence of Prof. Whitham's previous publications, but fortunately this has no very serious influence upon the general usefulness of the work.

Annual Report of the City Engineer of Providence, R. I. By J. Herbert Shedd, City Engineer. Snow & Farnham, City Printers.

This report contains a large amount of matter relating to the details of the city work, which is of no great general interest, but it gives some valuable statistics, among which are the tabulated register of meteorological observations and some specimen records of the rise and fall of tides, taken from a self-registering tide gauge.

In an appendix to the report are given a table showing the loss of head due to the friction of water in smooth pipes, together with formulæ, and a supplementary table for the determination of theoretical velocities in pipes beyond the limits of the principal table. This principal table is worked out for sizes of pipe varying from ½ in. to 2 in. in diameter, and comprises six columns with headings as follows:

(a) Mean velocity of water, in feet, per second; (b) Head, in feet, required to produce this velocity; (c) Discharge, in U. S. gallons, per minute; (d) Loss of head, in feet, due to friction, per 100 ft.; (e) Discharge, in U. S. gallons, per 24 hours; (f) Loss of head, in feet, due to the orifice of influx.

Railroad Topics.—This is the title of a 16-page monthly magazine which has just appeared in Montgomery, Pa. The title page announces that it is "The only railroad journal published in Central Pennsylvania," and the editor has started out courageously to cover his field, by printing a good variety of items and gossip about the men on the railroads in that region. The frontispiece and first article consists of a portrait and sketch of Major John Wynne, Yardmaster at Lock Haven, Pa., who was recently elected Mayor of that city. The closing pages are filled up with miscellaneous matter, after the fashion of the weekly papers working on the syndicate plan. Possibly the latter will be the most taking feature for most of the readers. There is one highly interesting "topic," a portrait of Miss Elizabeth Bisland in ball-dress; though we cannot see how she can be called a railroad topic. It is true that she traveled by rail part of the way when she raced with Nellie Bly around the world in 1890, but even the humorous editor of the New York *Sun* would admit that this theory is far-fetched. "Art and Society" ought to be at least a sub-title for this magazine.

Report on Water Supply and Sewerage, Massachusetts State Board of Health, Boston: Wright & Potter Printing Co. 1890.

The State Board of Health of Massachusetts, on its reorganization in 1886, was intrusted with the important duty of carrying out the provisions of the "Act to Protect the Purity of Inland Waters." The task was divided into two general departments—"Water Supply," the subject of the present volume, and "Sewerage," which will occupy Part II. of the report. The investigation embraces chemical and biological examinations of the waters taken from rivers, wells, lakes and reservoirs in all parts of the State, and the interpretation of the analyses; also the rainfall, temperature of air and water, and the broad question of pollution and self-purification of streams. The work throughout shows the most exhaustive research, and is characterized by an admirable classification of its vast store of valuable detail.

TECHNICAL.

Manufacturing and Business.

The Solid Steel Casting Co., of Alliance, Ohio, has been experimenting for a long time to determine how to make a solid steel casting for drawbars and knuckles. As a result of their investigation the company are now ready to sell drawheads and knuckles of cast steel as free from blowholes as any castings of iron can be made, and having a toughness and strength which especially recommend them for this work. With the new product the vertical plane coupler can be so much reduced in weight that its total cost is not greater than that of those of malleable iron.

The Westinghouse Machine Co. has appointed Mr. T. F. Wetherbee, General Agent for the State of Durango, Mexico, with headquarters at the City of Durango.

The Carlton-Johnson Railway Signal Co. has been incorporated in Georgia to manufacture an automatic electric block signal system. The capital stock of the company is $100,000, and the incorporators are Virgil Powers, J. A. Carlton and H. L. Johnson.

The Steele Signal Co., of Chicago, has been incorporated to manufacture railroad signaling appliances. The incorporators are Charles Higgins, Harry W. Powers and Robert E. Davidson.

The Buda Foundry & Mfg. Co. has moved its works from Buda, Ill., to the new town of Harvey, near Chicago, where it has erected large shops and will be able to increase its output. The plant at Buda has been purchased by the citizens, who will operate it under the name of the Buda Iron Works.

J. W. Bryan, J. O'Hara and S. D. Rouse have incorporated the Turner-Beard Brake Co., at Covington, Ky., to manufacture brakes for locomotives and cars.

The Pittsburgh Reduction Co. has closed down its works for two weeks to make repairs. The company will probably use coal as fuel when the plant resumes. During March there were cast at these works 13,166 lbs. of aluminum in ingots, a higher production than ever made in one month before.

The Damascus Bronze Co., of Allegheny, Pa., has just increased the capacity of three of its melting furnaces from 250 to 500 lbs., its total equipment of melting furnaces now being eight that contain 500 lb. pots and three that contain 250 lb. pots. Last year the company made and sold over 1,400,000 lbs. of bronzes.

The Gould Coupler Co., of Buffalo, N. Y., has had plans prepared for an extensive plant at Black Rock, near Buffalo, which will be operated in conjunction with the Gould Steam Forge. The plans provide for founding shops 660 ft. long and 80 ft. wide, an annealing room, 520 × 80 ft., and shipping, tumbling and core rooms, each 125 × 80 ft. The buildings will be of brick. The company will build at first a section of 370 ft. of the molding shops. The shops now employ 150 men, and when the improvements are completed there will be room for 2,000 employés. The capacity with the present plant has been 400 couplers a day, but the new shops will give a capacity of 600 a day.

Vice-President E. H. Goodman, of the Union Switch & Signal Co., of Pittsburgh, has made a statement of its financial condition. The report gives the earnings from sales for the 12 months ending December 31, 1890, as $760,869; operating expenses as $647,708; settlement of accounts, $20,840, a total of $668,548; earnings, $92,321, less the interest on bonds, $17,766, and interest and discount, $10,251; the net earnings over expenses and interest of all kinds were $64,304. The contracts made during the year 1890 were as follows: For interlocking switches and signals, $458,174; electrical signals, bells, etc., $143,694; frogs and switches, $82,404; sundries, $61,821; total, $746,094. The contracts for 1889 amounted to $551,128, showing an increase in 1890 of $194,967. Mr. Goodman states in a circular letter accompanying this exhibit that the company is now figuring on contracts for $1,100,000 worth in its various departments, with a likelihood that most would be secured.

The Excelsior Car Roof Co. was incorporated in Illinois last week by C. M. Jennings and George F. Hoke and others. The capital stock is $75,000.

The Eureka Nut Lock Co. has been recently chartered in Pennsylvania by William H. Hays, David E. Park and John W. Park, of Pittsburgh. The capital stock is $30.

Iron and Steel.

The Harriman Wrought Iron Co. has been incorporated and organized in New Jersey, with E. K. Sequine, of 76 Montgomery street, Jersey City, as President, and is now building a wrought-iron furnace at Harriman, Tenn. The authorized capital is $200,000.

The Carbon Iron Co., of Pittsburg, has leased the steel department of the Springfield Iron Co., at Springfield, Ill., and will put it in operation about May 10. The plate mill belonging to the plant is a modern one, 31 × 112 in., and the Carbon Co. will roll plates for the Union Iron Works, San Francisco, having a contract for 4,000 tons of plates. Two new heating furnaces, hydraulic cranes and improved shearing arrangements will be added to the Springfield works.

The Malleable Iron Co., of Chattanooga, Tenn., is preparing to add a steel plant to its works.

The North Carolina Iron & Steel Co., of Greensboro, N. C., which was organized last year to build a furnace and steel works, has elected James D. Kase, of Danville, Pa., General Manager, and will at once let the contract for the iron furnace and prepare to open its ore mines.

The Cold Rolled Steel Co. has been organized in Pittsburgh by W. H. Nimick, H. H. Jack, James W. Tyson, Jr., W. J. Howard, Jr., and Samuel B. Shoemaker. The capital stock is $50,000, with privilege to increase. It is the intention to make all shapes of cold-rolled steel, including sheets, plates, round, half-round, half-oval, etc.

William Todd & Co., of Youngstown, O., have just shipped to the Pennsylvania Steel Co., at Sparrow's Point, some elaborate rail mill tables of Henry Aiken's designs. The firm is also building two Porter-Hamilton engines for the same works. In the shops are rolling-mill engines for the Shenandoah Furnace Co., the Cleveland Rolling Mill Co. and the Ætna Iron & Steel Co., of Bridgeport, O.

The new plant of the Boston Iron & Steel Co., in course of erection at McKeesport, Pa., is rapidly nearing completion. The furnaces are about completed, and part of the machinery is on the ground.

At Pittsburgh this week a decree was granted by the courts for the dissolution of the Steubenville Iron & Steel Co., of Steubenville, O. The plant was formerly known as the Alikanna Rolling Mill, and has been operated for some time by the Cartwright Iron & Steel Co.

The Bates Steel & Iron Co., capitalized at $100,000, has been incorporated at Columbus, O.

Another iron furnace is to be built by the Radford-Crane Iron Co., of Radford, Va., as soon as the completion of the one now in course of construction.

The Trinidad Rolling Mills & Iron Co., Trinidad, Col., has been leased to Ralph J. Wick, of Youngstown, O., with the privilege of purchasing it at the end of a year for $26,900.

The Edgar Thomson Steel Works of Carnegie & Co., at Braddock, Pa., which have been closed for 10 weeks, resumed April 21, giving employment to about 2,000 men. The resumption, it is said, will be only for a short time.

The New Glasgow Coal & Railway Co. has given out contracts for the erection of blast furnaces near New Glasgow, N. S., where the company owns iron ore and coal lands and deposits of lime, all within a radius of 10 miles. John F. Stairs, M. P. for Halifax, is President.

The contracts for the masonry work for the buildings of the steel plant to be erected at Buena Vista, Va., by the Buena Vista Steel Co., were let last week by the chief engineer, Julian Kennedy. The iron work and machinery will probably be ordered in Philadelphia.

The Rail Market.

Steel Rails.—No large orders were reported by any of the mills this week but the quotations of $30.75@$31 at New York, $31 at Chicago, and $30 on cars at Pittsburgh, are maintained. Both the eastern and western mills have sufficient orders to keep them busy for two months.

New Car and Machine Shops.

The Central of New Jersey has purchased 70 acres of meadow land at Elizabethport, N. J., east of its main tracks, for the purpose of transferring its repair shops from the more populated section of the city, where the facilities are inadequate. It is proposed to enlarge the shops, and concentrate the repair works done now at various points on the road.

The new erecting shop of the Wagner Palace Car Co., at East Buffalo, N. Y., is approaching completion, and will soon be ready for occupancy. The walls are up, and the building of the truss roof is now in progress. An electric transfer table is to be put in, and will be ready for use when the addition of the shop buildings is finished. The company will expend about $100,000 in the enlargement of its plant.

The Wheeling & Lake Erie has decided to construct its general machine and repair shops at Toledo the present year. The new shops will be located in East Toledo, near the Craig shipyards. They will give employment to 350 men when in full operation. The plans for the buildings are being drawn.

The plans for the Missouri, Kansas & Texas shops to be built at Greenville, Tex., have been completed by the chief engineer.

The Texarkana Car and Machine Shops at Texarkana, Ark., were destroyed by fire April 11. The loss approximates $20,000. The origin of the fire is unknown.

Three of the buildings of the Memphis & Charleston shops at Sheffield, Ala., the roundhouse, machine shop, and blacksmith shop will be completed this week. The contractors will immediately begin to re-erect the wood-working building when the shops have been turned over to the railroad company. The office building needs only

the roofing to be ready. It is thought that this plant will be in operation by the middle of May.

It is reported that an option on 80 acres of land near Alanta, Ga., has been secured by the Georgia, Carolina & Northern as a site for machine and car shops.

The New York, Chicago & St. Louis will probably build large new shops at Fort Wayne, Ind.

The Raleigh & Gaston shops, at Raleigh, N. C., will be removed to a point on the line further south, and larger shops erected to accommodate the work now done at Raleigh and at the Carolina Central shops. The present Raleigh shops will be continued as repair shops.

Fire last week destroyed the building of the Canadian Pacific at Hochelaga, Que., which contained the pattern rooms and the cabinet shop. The insurance is $90,000, which covers the loss. The building was a two-story one, 150 × 75 ft.

The works of the Springfield Car & Foundry Co., at Springfield, Mo., were burned April 18. The loss is $80,000; insured.

The Georgia Pacific has completed a new roundhouse with 24 stalls at Birmingham, Ala. The building is of brick with iron roof.

The Siberian Railroad.

A Reuter's telegram relates that a group of French capitalists have offered the Russian government to construct 7,198 versts, 4,786 miles, between the ports of Vladivostock and Tchelcabinsk in consideration of either the bonds lately issued by the government, or for permission to issue abroad a loan of 300,000,000 roubles for the enterprise, asking from four to seven years in which to construct the line. If the rouble is valued at 75 cents, this is at the rate of about $47,000 per mile. George Dobson, in "Russia's Railway Advance into Central Asia," says that the officially stated cost of the last section of the road to Samarcand was 20,823 roubles per verst, or about $23,500 per mile, and there seems no reason why General Annenkoff, who has the American genius for railroad building, should, aside from the greater cost of the bridges, make the Siberian railroad cost much more. This view of the case would allow the French syndicate nearly 100 per cent. for raising the money and profits.

Car Coupler Test.

A test of the new cast-steel car couplers, made for the St. Louis Car Coupler Co. by the St. Louis Steel Foundry, was made in the Cairo Short Line yards at East St. Louis on April 18. A refrigerator car with the new couplers was used against a loaded box-car with plain draw-bars.

The refrigerator was driven against the stationary car at a speed of 15 miles; the head of the link and pin coupler was broken short off; steel coupler in perfect condition, showing a dent, where the blow was given; end timbers of the cars driven in and displaced.

Third Test—The knuckle was removed and the refrigerator driven at the rate of 12 miles an hour against the standing car, in which another bar had been placed; end timbers of car give away; the old-fashioned bar wedged itself in the jaws of the steel coupler; no breakage on either bar.

The steel coupler was finally broken by shifting out of position, owing to the shattered condition of the end timbers, and receiving a side blow on the tip of the casting, which knocked off a piece of the lip. No other damage was sustained.

The Manchester Ship Canal and the Nicaragua Canal.

Advices from England show that the Corporation of Manchester will probably apply to Parliament for power to lend the Manchester Ship Canal Company £3,000,000, so that they can complete the canal, although Mr. G. H. Hill, the engineer employed by the corporation estimates that the additional capital required will not exceed £2,457,491. The special committee of the corporation reported that it was prudent to acquire power to lend the larger sum, instead of running any risk of delaying the completion of the canal through insufficient means. It is explained that over £360,000 of this deficiency is due to purchases of a speculative character, of land outside of the necessities of the canal, and the balance is involved in protective clauses obtained by the Mersey Dock Board, and other local authorities, necessitating increased expenditures, and through the death of Mr. Walker, the contractor, and the subsequent cancellation of his contracts. The loan of the corporation does not stand before the existing debentures, but has priority to the stock, and is to be repaid after the completion of the canal, when the company obtains further borrowing powers.

It is expected that the lower section of the canal from Eastham to the mouth of the Weaver will be opened within two months. This will liberate a considerable amount of the plant, which now seems to belong to the corporation of Manchester, and it is proposed to sell this to the Nicaragua Canal Co. on terms which have not yet been made public. A late inventory of the plant in use on the canal shows that there are four floating dredges, 96 steam excavators, 173 locomotives, 192 steam cranes, most if not all of which are self-propelling; 182 portable and other steam engines, 212 steam pumps, 6,300 cars and 228 miles of track. If the Nicaragua Canal Co. could obtain such portions of this plant as are necessary, in exchange for its stock, it would doubtless save a very large cash outlay.

Chignecto Ship Railway.

More or less work was carried on during the latter part of the winter at the Tidnish end of this project. Blasting was done in the bottom of the basin under the ice. No less than 1,330 holes were cut through the ice, which formed a platform and admitted of the work being prosecuted much more advantageously than it could be in summer, though its rise and fall with the tide added to the difficulty. The rock lay 10 to 15 ft. under water. Between two and three tons of dynamite was used. Several hundred men have been working during the winter at the terminus. In two or three weeks a large number will be added, and by May 1 work will proceed vigorously all along the line.

Continuous Brakes in South Australia.

The Government Board appointed to test continuous brakes for the colony of South Australia has made a report. As the reader will remember, the Vacuum Brake Company did not take part in these tests, the Westinghouse being the only entry. The trials were made on narrow-gauge lines with trains of 50 vehicles. Stops were made on descending grades of 88 ft. to a mile, and on the level. The tests for graduation down steep grades are reported to have been very successful and satisfactory to the Board. All of the five members of the Board reported in favor of the Westinghouse quick-acting brake. One of them, however, while approving of this for broad-gauge rolling stock suggested that for narrow-gauge lines it would be better to defer to the practice in adjacent colonies, with a view to the interchange of cars. It does not appear, however, that the vacuum brake is used in Queensland, the only other colony with which railroad connection is likely soon to be made. One other member of the board objected to the application of a continuous brake on freight trains.

THE SCRAP HEAP.

Notes.

The Southern Pacific has placed train collectors on a number of the heaviest trains of the California divisions.

The Wisconsin House of Representatives has indefinitely postponed a bill reducing passenger rates on railroads to two cents per mile.

Conductors, engineers, firemen and brakemen of the Indiana Midland have struck for six months back pay. The engineers took the mail cars through without any passenger coaches.

Mr. John L. Miles, of Camden, N. J., has just delivered the third one of four new car floats contracted for by him for the Philadelphia & Reading. The floats are built to carry eight cars each.

William Ryan, a tower switchman of the Prospect Park & Coney Island road, was killed in his tower at Kensington Junction, L. I., on the night of April 20. Ryan had just received his pay, and it is supposed that he was murdered for the money.

The New York Central has issued an order limiting the number of times that newsboys may go through the cars of passenger trains, and the boys are vigorously protesting because their profits are reduced. A number of them refused to make their trips.

The Pennsylvania has decided to build two docks at Erie, Pa., each dock to be 1,100 ft. long and 700 ft. wide, and will make that port the centre for the handling of coal shipments and iron-ore receipts to and from the Lake Superior region. The company will expend $2,000,000 on improvements at Erie this year.

The Peters Cartridge Co. has obtained a verdict at Cincinnati against the Pittsburg, Cincinnati & St. Louis for $96,000. The suit was on account of the slight collision on a side track at King's Mills, O., July 15, 1890, in which a car bumped against another filled with powder. The powder exploded and killed eight men and destroyed the cartridge company's works.

A detective of the Pittsburgh & Lake Erie has arrested five of a gang of thieves, who are said to have made away with $100,000 worth of plunder from freight trains within the last four years. Three of the leaders are in jail at Pittsburgh, the other two at McKeesport. Informations have been made against 31 others. One of those arrested has made a full confession.

Organizing a Merchants' Freight Bureau.

A St. Louis paper gives the following details of the plan under which the commercial bodies of that city are taking measures to form an organization under which they will employ a commissioner to supervise their dealings with the traffic department of railroads:

"The directors of the St. Louis Traffic Commission met yesterday. A committee presented a report, which was adopted. It proposes: 1. Membership of commercial and industrial bodies to range from $100 to $4,000 per annum. 2. Membership of individuals, firms and corporations to be for a term of three years, and to include four classes, which are to pay the following sums annually: First class, $200 and over; second class, $100; third class, $50; fourth class, $25; the position as to classes to be arranged between the parties and the commission. 3. Payments to be made quarterly in advance. 4. The annual dues are to be scaled down pro rata whenever the income exceeds the expenses. The signer is also released whenever he goes out of business. Mr. Geo. W. Fuller, chairman of the freight committee of the Kansas City Commercial Club, spoke as to the general success of their organization. A committee was appointed to select and nominate a candidate for commissioner. They were directed to make a search for the most competent traffic man in the United States whose services are available at the present time. The commission appears to realize that if it is to command respect in the railroad world its commissioner must be a man of recognized ability, who can obtain a hearing in any general office to which his duties call him. Such men are scarce and 'they come high.' The salary to be paid will not be less than $10,000 per year, and it may go as high as $15,000."

Automatic Couplers and Brakes in Nebraska.

Governor Boyd has signed the law in regard to automatic couplers and brakes. The bill provides that it shall be unlawful to put into use in that state any new car or cars that have been sent to the shop or shops for general repairs, or whose draft rigging has to be repaired with a new drawbar or bars, that are not equipped with safety or automatic couplers or drawbars such as shall not necessitate the going between the ends of the cars to couple or uncouple them. After Jan. 1, 1895, it is made unlawful to use in transportation of freight or passengers any car that is not equipped with such automatic couplers. It will also be unlawful to use any locomotive in that state after May 1, 1892, that is not equipped with an efficient driver brake, or to run trains after Jan. 1, 1895, that shall not have in them a sufficient number of cars equipped with power brakes so that the engineer can control the train. The penalty is a fine for each offense of not less than $500, nor more than $1,000.

The Inventors' National Association.

One of the events of the Patent Centennial celebration just held at Washington, D. C., was the formation of a National Association of Inventors and Manufacturers. The election of officers and directors for the ensuing year resulted as follows: For President, Dr. R J. Gatling, of Hartford, Conn., the inventor of the celebrated gun which bears his name. The four Vice-Presidents are Dr. Gardner G. Hubbard, of Washington, D. C.; Prof. William A. Anthony, President of the American Institute of Electrical Engineers; Thomas Shaw, Esq., Philadelphia, inventor and manufacturer, and patentee of 110 inventions, and Hon. Benjamin Butterworth, Ohio, former Commissioner of Patents, ex-Chairman of the House Committee on Patents, and now Secretary of the Columbian Exposition. The selection of Mr. J. Elfreth Watkins, Curator at the National Museum, as Secretary, met with unanimous approval. Mr. M. C. Stone, of Washington, an inventor and manufacturer, was elected Treasurer. The Board of Directors is composed of the following gentlemen: John Wise Smith, engineer, Pennsylvania; David G. Weems, electrical railway engineer, Maryland; Prof. R. H. Thurston, of Cornell University, New York; Chas. F. Brush, Ohio; Otis T. Mason, Curator, National Museum, Washington, D. C.; Hon. David M. Smith, manufacturer of sewing-machines, New Hampshire; F. E. Sickels, inventor of steam steering machinery, Kansas City, Mo.; Oberlin Smith, manufacturer, New Jersey, and R. S. Munger, manufacturer of cotton machinery, Alabama. In addition to the regular officers and board of directors, there will be representatives in every state, some of which have already been appointed. At an informal meeting it was suggested that there be a committee of seven on legislation to advance the interests of the patent system before Congress, and guard against any encroachment upon the rights of inventors and manufacturers.

The constitution and by-laws, with particulars as to eligibility to membership, will be ready for distribution in a very short time. The annual dues for active membership will probably be fixed at $5, and life membership $100. Provision is also made for associate and honorary members.

The Kipton Collision.

A butting collision at Kipton, O., on the Lake Shore & Michigan Southern, April 18, resulted in the death of two engineers and six postal clerks, a fireman and a man standing on the station platform; and wrecked two engines, three mail and one baggage car. The trains were a westbound accommodation train, No. 21, of six cars, and eastbound fast mail train, No. 14, consisting of three mail cars and two parlor cars. The wreck was a very bad one, and one of the cars fell against the station building, damaging it somewhat. No passengers were seriously injured, but of the 64 revolving chairs in the two parlor cars only four remained fastened to the floor. The blame is laid upon the engineer and conductor of train 21, who left Oberlin without sufficient time to reach Kipton for train 14, which had the right of track.

A Cleveland paper gives the circumstances as follows: The collision occurred at 4:52 p. m., and the trains met just at the east end of the station. The engineer of 21 was on the way past the depot to place his train on the siding a short distance west, and train 14 was coming eastward at full speed. It was shown that because of a curve just west of the depot, and a freight train on a siding north of the main track, the engineer did not see the west-bound train until it was too late to avert the accident; and that by the records, though the statement was contested, that train 21 left Oberlin, which is 4½ miles east of Kipton, eight minutes behind time. The train should have left Oberlin at 4:38, but did not leave until 4:46, and it arrived in Kipton at 4:52, so that the trip was made in six minutes. It was shown to the satisfaction of the superintendent that the fast mail was not two or three minutes ahead of time, as has been claimed, but that the west-bound train arrived at the depot at the very moment the east-bound train was due there.

A Draw-Bridge Accident.

On the afternoon of Monday last a passenger train on the Staten Island Rapid Transit road was started from the station at Port Richmond, S. I., directly in the face of a caution signal giving warning that a draw bridge, 650 ft. distant, was open; and the engine and the first truck of the forward car (combination) ran into the opening. But no one was seriously injured, the men on the engine jumping and the passengers in the first car being at the rear end of it. The engine sank clear of the bridge and the passenger car was pulled back upon the track without much difficulty. The distant signal, which is interlocked with the bridge, is an ordinary semaphore, and was about 150 ft. in advance of the runner at the time he started. The home signal is a disc on the top of the framework of the draw. The runner seems to have been entirely oblivious to his surroundings, and can give no explanation of his negligence. The bridge tender succeeded in drawing his attention, however, so that he reversed the engine before jumping off.

The Commissioners' Safety Appliances Committee.

At the Convention of Railroad Commissioners held in Washington, in March George G. Crocker, of Massachusetts; James C. Hill, of Virginia; Spencer Smith, of Iowa; William E. Rogers, of New York, and John H. King, of South Dakota, were appointed a committee to secure Congressional action in regard to safety appliances for cars. This committee will hold its first meeting in Washington on April 25, when it will proceed to outline its work.

Buffalo Improvements.

It is said that plans have been practically perfected for the erection of a large new freight station in Buffalo for the joint use of the New York Central and West Shore; also that an arrangement has been made by which the Western New York & Pennsylvania will use the New York Central's passenger terminals. The carrying out of these improvements and the abolition of the Western New York & Pennsylvania passenger station will materially simplify the grade-crossing problem which has been under consideration by the city government for a long time.

An Appropriate Costume.

"What was the idea of dressing the little page at the Revere wedding like a western desperado?" "Oh, he was to hold up the train you know."—*Puck.*

LOCOMOTIVE BUILDING.

The Schenectady Locomotive Works have recently completed six switching engines for the Southern Pacific. It is stated that an order for an additional six engines will be let very soon.

CAR BUILDING.

The Cleveland, Cincinnati, Chicago & St. Louis has recently placed an order with the Missouri Car & Foundry Co. for 1,000 cars.

All of the 1,000 box and 50 stock cars ordered some time since from the Pullman company for the Philadelphia & Reading have been delivered and the car company is now delivering the twin hopper gondola cars contracted for. All these cars are equipped with the Van Dorston cushioned automatic coupler. Murray Dougall & Co., of Milton, Pa., are also constructing for the Philadelphia & Reading 1,000 gondola and 200 hopper cars, which are similarly equipped and are being delivered as finished.

BRIDGE BUILDING.

Akron, O.—The city authorities have renewed their requests that the Cleveland, Akron & Columbus and the New York, Pennsylvania & Ohio should build a bridge over their tracks at Park street, and an ordinance will probably be passed by the City Council.

Amsterdam, N. Y.—A bill has been reported in the New York legislature from committee, appropriating $5,000 for a bridge over Bridge street, in Amsterdam.

Anacortes, Wash.—The contract for building the steel drawbridge for the Seattle & Northern across Swinomisshlough has been let to R. Wakefield, of Portland, Ore. The bridge will be completed in four months.

Bound Brook, N. J.—The Philadelphia & Reading has awarded the contract for the superstructure work on all the bridges on the Port Reading extension between Bound Brook and the Arthur Kill to the Phœnix Bridge Co., of Phœnixville, Pa.

Brenham, Tex.—The Missouri Valley Bridge & Iron Works, of Leavenworth, Kan., has just completed an iron Pratt truss bridge 80 ft. long across the Yegua River, 13 miles north of Brenham.

Cheyenne, Wyo.—The first span, 67 ft. long, of the iron and steel viaduct over the Union Pacific tracks between North and South Cheyenne, has been completed.

Chickamauga, Ga.—The Crawfish Springs Land Co. is reported to have prepared plans for a contemplated iron bridge on its lands.

Columbus, Ga.—The iron work on the new bridge being built by the Mobile & Girard across the Chattahoochee River at Columbus is about finished. The approaches are being pushed rapidly.

Delta County, Col.—The superstructure for a steel suspension bridge across North Sulphur Creek, at Hawk Stewart, has been finished by the contractors, and is now ready for erection.

Dublin, Ga.—The County Commissioners are building an iron bridge across the Oconee River about a mile from Dublin. The eastern approach has been finished.

Elizabethton, Tenn.—Elizabeth county has made an appropriation of $1,500 to build a bridge across Buffalo Creek, near Milligan College.

Elliston, Va.—Sealed bids will be received by the commissioners of Montgomery County Court, Va., until May 1, for building an iron bridge across the south fork of Roanoke River at Elliston, Va. The bridge is to be a single span of 105 ft., and 12 or 14 ft. wide.

Elwood, Pa.—Two large iron bridges are being erected at Elwood by the Pittsburgh Co. One of the bridges, which is 1,200 ft. long and 137 ft. high, with a double track for railroad purposes, will be completed in about six weeks. The second bridge, 400 ft. long and 60 ft. high, will be finished within a month.

Glasgow, Va.—The Glasgow Development Co. proposes to erect a bridge across North River, at Glasgow, Va., for the purpose of connecting its property with that of the Rockbridge company. The bridge is to be 250 ft. long and 50 ft. wide.

Hamilton, Ont.—At the adjourned annual meeting of the Hamilton Bridge Co., the following officers were elected: President, W. Hendrie; Vice-President, John S. Hendrie; Manager, C. Teifer; Secretary and Treasurer, John Stewart. Directors: Matthew Leggat, A. T. Wood, Alexander Gartshore. The company has several large contracts on hand. A large addition to the shops has just been completed.

Mount Vernon, Ind.—Proposals are asked by the town council until April 28, for erecting an iron bridge with piers and approaches.

Nepean Point, Ont.—The plans and specifications of the International Company's railroad and wagon bridge over the Ottawa River at Nepean Point are now being prepared. As soon as they are completed the directors will ask a bonus from the Ontario government, and the Dominion government, as well as Quebec, will be petitioned for assistance to complete the work.

Rochester, N. Y.—The City Surveyor has nearly completed plans for the proposed bridge at Alexander street.

San Antonio, Tex.—A new iron bridge across San Antonio River at Convent street has just been completed.

San Francisco, Cal.—John P. Sheldon, formerly of the American Bridge Co., has formed the Western Bridge Co., and opened an office at 17 Stuart street, San Francisco.

Sea Isle City, N. J.—The West Jersey Railroad will replace the wooden bridge at Townsends Inlet, near Avalon, this summer with an iron structure.

Spuyten Duyvil, N. Y.—The War Department has begun proceedings to have the draw of the Harlem River bridge of the New York Central & Hudson River road at Spuyten Duyvil widened. The War Department engineers propose that the draw be widened from 28 ft. to 50 ft., and that the structure be raised.

Terre Haute, Ind.—Proposals are wanted until April 28, by George H. Simpson, Engineer, for the construction of three iron bridges.

Various Projects.—The Legislative Assembly, Northwest Territories, has asked for tenders for the construction of a bridge across Cottonwood Creek.

Youngstown, O.—The State Senate of Ohio has passed a bill authorizing the commissioners of Mahoning County to issue $60,000 of the county bonds to build a bridge over the Mahoning River at Youngstown.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

In New Hampshire the Supreme Court rules that a contract between rival and competing railroad companies, made for the purpose of preventing competition, but not for the purpose of raising the prices of transportation above a reasonable standard, is not void as against public policy.[1]

In Kentucky it is held by the Court of Appeals that, where a railroad is owned by one company but controlled and operated exclusively by another, the former is in no way liable for any injury caused by the negligent management of a train by the employes of the latter company.[2]

The Mississippi code provides that the franchise of a railroad corporation may be sold to satisfy a judgment, the purchaser to have the rights and duties given and imposed by the charter. Section 1,039 allows six months for redemption. Section 1,041 provides that all corporations, after their charters have expired or been annulled, shall nevertheless be continued bodies corporate for three years thereafter for the purpose of suing and being sued and closing up their business. The Federal Court decides that, where a railroad franchise was sold with the rest of the property on a decree of foreclosure, and the purchaser organized a new organization under an act of the legislature, the old corporation ceased to exist at the end of three years thereafter.[3]

In the Federal Court it is decided that where a grant to a railroad company excepts mineral land, the term "mineral land" means land known to be mineral land when the grant took effect, or which there was then satisfactory reason to be believed to be such.[4]

A Michigan statute of 1848 is entitled "An act relative to specific state taxes on plank road, mining and other corporations not enumerated in the Revised Statutes of 1846," and provides that, "in all cases where any incorporated company hereinafter to be incorporated is made subject to the payment of the specific state tax, this state shall have a lien on all the property of such company to secure the payment of said tax," etc. When this act was passed the constitution had no provision requiring the object of the act to be expressed in the title. The Supreme Court holds the statute applies to railroad as well as other corporations subsequently formed.[5]

In New York the Court of Appeals rules that where the right of way of a railroad company expires with the life of the corporation, and the original company was dissolved by merger into a new company, which has operated the road for than 20 years, the new company acquires the right of way by adverse possession and user.[6]

In the same state the Supreme Court holds that the receiver of a railroad company, who is operating the road in the usual manner, cannot escape liability for injuries to his employés owing to the employment of an insufficient number of trackmen to keep the track in good repair, on the ground that the lack of sufficient trackmen was owing to the want of funds in his hands, as the road was not paying running expenses.[7]

In Mississippi the charter of a railroad provided that "all taxes to which the company shall be subject" for 30 years are set apart to pay debts incurred in constructing its road, or for money borrowed on its lands therefor. By another section it was authorized to receive gifts of land, and to take subscriptions to its stock payable in land. The Supreme Court holds that the exemption extended only to taxes on property necessary to the construction, maintenance and operation of the road, and not to outlying lands acquired for resale, or for the timber thereon.[8]

Carriage of Goods and Injuries to Property.

In Alabama the Supreme Court rules that where goods in transit are lost through the negligence of the employés of the railroad the measure of damages is the market value of the goods, though the bill of lading contains an arbitrary limitation of defendant's liability to the amount of $5 per 100 lbs.[9]

In New York it is held by the Supreme Court that the Pennsylvania act of June 4, 1883, declaring unlawful and forbidding certain undue or unreasonable discriminations by railroad companies and other common carriers, etc., in the transportation of property, and providing that "any violation of this provision shall make the offending company or common carrier liable to the party injured for damages treble the amount of injury suffered," is a penal statute, and an action thereon cannot be maintained in the courts of another state.[10]

In New York the plaintiff's goods, in possession of a railroad company, were placed on storage with defendant, the company's storekeeper. After the sale of the goods by the company as unclaimed baggage, plaintiff tendered the freight charges to defendant, and demanded the return of the goods, and, the demand not being complied with, brought trover for their conversion. The Supreme Court holds that there had been no conversion by defendant, and that it was error not to permit him to prove the sale of the goods by the company.[11]

In Texas a quantity of cotton was destroyed at the burning of a compress. Several witnesses were near when the alarm sounded, but did not know what caused the fire. The switch-engine had not been near for 3½ hours. The cotton was on two cars on a side track, near the compress. One of the cars was saved. What effort was made to save the other was not shown, nor what precautions had been taken for the protection of cotton in cars on the side track. The Supreme Court decides that the evidence did not show that the loss occurred without fault on the part of the carrier.[12]

In Georgia a mule was killed by a train at a point where it could have been seen by the engineer an eighth of a mile away. The mule was observed by the engineer standing very close to the track, and the latter took what he deemed the most effectual means of scaring the mule away—opening the cylinder cock. But he continued at a high rate of speed and did not blow the whistle. The Supreme Court holds the railroad liable.[13]

Injuries to Passengers, Employes and Strangers.

In New York it is laid down that, where the inhabitants of certain houses situated near a railroad have for years been in the habit of crossing the track at a certain place with the acquiescence of the company, such acquiescence amounts to a license, and imposes a duty upon the company as to such persons to exercise reasonable care in running its trains at that place.[14]

In Wisconsin it is ruled by the Supreme Court that where the crossing at which the accident happened was on a much-traveled street, and at the time plaintiff approached it an engine and cars blocked the way but presently moved off, and, when the flagman motioned the teams to cross, the engine was concealed by buildings but was still near the crossing, and the noise caused by the escaping steam frightened plaintiff's team, it is sufficient to support a verdict for plaintiff.[15]

In Iowa a fire was started on land by defendant's engine, and plaintiff and his neighbor discovered the fire and tried to put in out; being unsuccessful, they went to the barn to save some horses belonging to the neighbor; when they entered the barn the fire was more than 100 ft. away, and the head fire had been running toward a point at one side of the barn, but at that time it reached higher ground, and, catching the full force of the wind, was driven directly toward the barn; when the horses were unfastened and were being taken out, the plaintiff discovered that the fire had reached the door, which was the only exit, and to escape he passed through the fire, and received the injuries complained of. The Supreme Court rules that the case is not demurrable on the ground that plaintiff's effort to save the property of his neighbor, rather than defendant's negligence in setting fire, was the proximate cause of his injury.[1]

In Wisconsin the deceased was last seen alive walking through defendant's yard, where cars were being switched in various directions, and left to run unattended and uncontrolled by any brakeman. The body of deceased was found near a sidewalk crossing, and from the blood marks on the track it appeared that he was struck while crossing the track on the sidewalk, and was dragged several feet beyond it. The Supreme Court rules that, though deceased was last seen alive in the yards, the evidence supported a finding that he was killed at the sidewalk, where he had a right to be, and that it should be presumed that he placed himself there without want of ordinary care[17].

In New York, while a pedestrian was standing on a railroad crossing outside of the westerly track, which was not in use for passing trains, a coal cart collided with a passing train, and was thrown forward upon him, inflicting injuries which caused his death. The trial judge refused to charge that if the negligence of the driver of the cart caused the accident plaintiff could not recover, but did charge that there could be no recovery if the accident was caused exclusively by the negligence of the driver. The Supreme Court decides that this court acted properly. It was proper to charge that if a sudden and instinctive effort on the part of the driver of the cart to escape impending danger after receiving warning thereof resulted in the accident, there not being sufficient time to form an intelligent and deliberate judgment as to the best means of escape, negligence was not imputable to him.[18]

In Wisconsin a railroad track intersected the sidewalk of D street at an acute angle. Plaintiff, at about eight o'clock in the evening, in December, carrying large bundles of clothes, in attempting to cross the track, was struck by one of defendant's engines. Plaintiff was unacquainted in the neighborhood. It was in a thicklysettled portion of the city. She was unaware that any railroad was there. The crossing was planked so that the walk was continuous, with no abruptions whatever. There were intervening trees and poles which tended to obstruct her view. There was no light or flagman on the crossing. She could have seen the headlight had she looked before attempting to cross the track. The train was running six miles an hour. The bell was rung continuously, and after it was possible for the engineer to have seen her there was not sufficient time to stop the engine before striking her. The Supreme Court rules that the question of negligence was for the jury, as the circumstances of the case make it an exception to the general rule requiring persons approaching a railroad crossing to look and listen before attempting to cross.

[1] Manchester & L. R. R. v. Concord R. R., 20 Atl. Rep. 383.
[2] Harper v. Newport News & M. V. R. Co., 14 S. W. Rep. 346.
[3] Ford v. D. & P. L. Co., 43 Fed. Rep. 181.
[4] Francœur v. Newhouse, 43 Fed. Rep. 236.
[5] Auditor-General v. Lake George & M. R. R. Co., 46 N. W. Rep. 730.
[6] Miner v. N. Y. C. & H. R. Co., 25 N. E. Rep. 339.
[7] Graham v. Chapman, 11 N. Y. Supp. 318.
[8] McCulloch v. Stone, 8 So. Rep. 236.
[9] Georgia Pac. Ry. Co. v. Hughart, 8 So. Rep. 62.
[10] Langdon v. N. Y., L. E. & W. R. Co., 11 N. Y. Supp. 514.
[11] McClellan v. Wyatt, 11 N. Y. Supp. 686.
[12] M. P. Ry. Co. v. China Mf'g Co. (Tex.), 14 S. W. Rep. 785.
[13] E. T., V. & G. R. Co. v Burney, 11. S. E. Rep. 1,028.
[14] Swift v. Staten Island R. T. R. Co., 25 N. E Rep. 378.
[15] Kalbus v. Abbot, 46 N. W. Rep.. 810.
[16] Liming v. Illinois Cent R. Co., 57 N. W. Rep. 66.
[17] Phillips v. M. & N. R. Co. 46 N. W. Rep. 543.
[18] Quill v. New York Cent. & H. R. R. Co., 11 N. Y. Sup. 80.
[19] Winchell v. Abbott (Wis.), 46 N. W. Rep. 665.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Baltimore & Ohio, semi-annual, 5 per cent. on the Washington Branch stock, payable May 1.
Boston & Maine, $4.50 per share on the common stock, payable May 15.
Lake Erie & Western, quarterly, 1 per cent., payable May 15.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Annapolis, Washington & Baltimore, annual, Baltimore, Md., May 4.
Atlantic City, annual, Camden, N. J., May 4.
Austin & Northwestern, annual, Austin, Tex., May 6.
Beech Creek, annual, Jersey Shore Junction, Pa., May 8.
Bellingham Bay & British Columbia, special, London and San Francisco Bank Building, California and Leidesdorff streets, San Francisco, Cal., May 4.
Canada & Michigan Central Tunnel, annual, Windsor, Ont., April 25.
Canadian Pacific, annual and special, Montreal, P. Q., May 13.
Central of New Jersey, annual, Jersey City, N. J., May 8.
Central Ohio, annual, Columbus, O., April 29.
Cheshire, annual, Keene, N. H., May 13.
Chicago, Burlington & Quincy, annual, Chicago, Ill., May 20.
Cincinnati, Hamilton & Dayton, special, 200 West Fourth street, Cincinnati, O., April 27, to perfect a lease of the Cincinnati, Dayton & Ironton road.
Cleveland, Cincinnati, Chicago & St. Louis, special, Cincinnati, O., May 6.
Cleveland, Lorain & Wheeling, annual, Cleveland, O., May 13.
Delaware & Hudson Canal, annual, 21 Cortlandt street, New York City, May 12.
Detroit & Bay City, annual, Detroit, Mich., May 7.
Detroit, Lansing & Northern, annual, Detroit, Mich., May 13.
Eastern (New Hampshire), annual, Portsmouth, N. H., May 5.
Houston & Texas Central, annual, Houston, Tex., May 4.
Junction, special, 22 Fifth avenue, Chicago, Ill., May 5, to act upon a proposed sale of the property and franchises to the Chicago & Northwestern.
Kansas City & Omaha, annual, Fairfield, Neb., May 5.
Lake Shore & Michigan Southern, annual, Cleveland, O., May 6.
Louisiana & Missouri River, annual, St. Louis, Mo., May 6.
Mexican Central, annual, Boston, Mass., May 6.
Michigan Central, annual, Detroit, Mich., May 7.
Minneapolis Western, annual, Room 102, 330 Hennepin avenue, Minneapolis, Minn., May 5.
Mohawk Valley & Northern, special, Vanderbilt avenue and Forty-fourth street, New York City, April 29.

New York, Chicago & St. Louis, annual, Cleveland, O., May 6.
Norfolk & Western, annual, Roanoke, Va., May 6.
Ohio River, annual, Parkersburg, W. Va., May 14.
Philadelphia & Chester Valley, annual, 227 South Fourth street, Philadelphia, Pa., May 4.
Pittsburgh & Western, annual, Allegheny, Pa., May 4.
Quebec & Lake St. John, annual, Quebec, Que., May 14.
St. Louis, Arkansas & Texas, annual, Texarkana, Tex., May 4.
St. Louis, Council Bluffs & Omaha, annual, St. Louis, Mo., May 6.
St. Louis & Memphis, annual, Lindsay, Ark., May 4.
St. Louis & San Francisco, special, Broadway and Pine street, St. Louis, Mo., May 7, to consider a proposed issue of bonds, and annual, May 13.
Shenandoah Valley, annual, Roanoke, Va., May 6.
Texas Panhandle, annual, Washburn, Tex., May 5.
Traverse City, annual, Traverse City, Mich., May 7.
Union Pacific, annual, Ames Building, 1 Court street, Boston, Mass., April 29.
Utah Central, annual, Salt Lake City, Utah, May 4.
Wisconsin Central, annual, Milwaukee, Wis., May 28.

Railroad and Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Society of Civil Engineers* will hold its next annual convention at Lookout Mountain, near Chattanooga, Tenn., commencing May 20.

The *Association of American Railway Accounting Officers* will hold its annual convention at the Southern Hotel, St. Louis, Mo., May 27, commencing at 10 o'clock a. m.

The *Master Car Builders' Association* will hold its annual convention at the Stockton Hotel, Cape May, N. J., commencing June 9, at 10 o'clock a. m.

The *New England Railroad Club* meets at its rooms in the United States Hotel, Beach street, Boston, on the second Wednesday of each month, except June, July and August.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* meets at its rooms, in the Gilsey House, New York City, at 2 p. m., on the third Thursday in each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of each month at 7:30 p. m. in the directors' room of the St. Paul Union Station, except in the months of July and August.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1 122 Girard street, Philadelphia, on the first and third Saturday of each month, excepting in January, when the annual meeting is held on the second Saturday of the month. The second January meeting is held on the third Saturday. The club stands adjourned during the months of July, August and September.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Penn Building, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursdays at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month, at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y. and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

Association of Virginia Engineers.

The Association of Engineers of Virginia was formed at a meeting of civil, mining and electrical engineers and architects, held in Roanoke, Va., April 4. A constitution and by-laws were adopted, officers elected, and other matters of organization were attended to. The association is to hold monthly meetings at Roanoke, and two meetings during the year at other points in the states, as decided by the directors. The officers of the association are: President, J. H. Wingate, of Roanoke; Vice-Presidents, W. E. Anderson, of Blackburg College, and C. R. Boyd, of Wytheville; Secretary, H. W. Newby, of Roanoke; Treasurer, J. R. Schick, Roanoke, Assistant Chief Engineer of the Norfolk & Western Company.

Engineers' Club of Philadelphia.

A regular meeting was held April 4, President Wilfred Lewis in the chair; 29 members and one visitor present. Prof. H. W. Spangler, discussing the paper of Mr. Kneass, on the flow of steam, said that while steam passes through an orifice at approximately a constant velocity, if an opening is made below the water level of a boiler the quantity of water passing out under any pressure in unit time is practically constant. This is due, of course, to the fact that as the water passes from the boiler into a passage in which there is less than boiler pressure, a portion of the water is converted into steam, and, while the velocity in this case is different from different pressures, the total quantity of water is practically the same at all pressures. In other words, as long as the pressure in the boiler is practically constant, the time of emptying the boiler is always the same through the same orifice. There was some discussion by Messrs. John C. Trautwine, Jr., C. Henry Roney and Wilfred Lewis. Mr. Thomas G. Janvier read a paper on "The Engineering Features of the Road Question." This branch of the road question should be divided into three parts: 1st, Location; 2d, Preparing the road bed; 3d, Laying the pavement. In locating, grading, land damages, etc., should not be overlooked. The grades should not exceed 7 ft. per hundred. The full width should not be less than 40 nor more than 60 ft., but the paved portion need only be from 18 to 24 ft. The Tilford pavement should be put down for very heavy travel, but for ordinary travel McAdam will answer. Important points to be observed for keeping a road in good condition: All dirt and mud removed as frequently as possible. The entire drainage system carefully maintained. Constant daily repairs and patches wherever and whenever ruts or depressions begin to show. Careful sprinkling three or four times a day in dry weather. The frequent use of a 2½-ton roller.

There was some discussion by Mr. C. H. Ott.

Mr. E. V. d'Invilliers, by request of the author, Mr. C. R. Claghorn, of Birmingham, Ala., presented a paper entitled "An Economical Review of the Alabama Coal Fields." There are three principal coal fields, the Warrior, Cahaba and Coosa, all exhibiting a southwest pitch or slope.

The Swedish Engineering Club, of New York.

The next regular monthly meeting of the club will be held at the club-rooms, No. 231, Union street, Brooklyn, Saturday, May 2.

The Technical Conventions.

The members of the Master Car Builders' Association and the Master Mechanics' Association and those who expect to attend the annual conventions at Cape May, N. J., in June, should reserve rooms at the hotel as early as possible. Mr. F. C. Walton, the proprietor of the Stockton Hotel, where the conventions will be held, may be addressed at No. 104 South Twenty-first street, Philadelphia, Pa.

PERSONAL.

—The Governor of New Hampshire has appointed Col. Thomas Cogswell, of Gilmanton, Railroad Commissioner, in place of Mr. John M. Mitchell, resigned.

—The President has appointed Mr. R. C. Kerens, of Missouri, to be a member of the International Railroad Commission, in place of Mr. George M. Pullman, resigned.

—Mr. C. H. Quereau, formerly Assistant Engineer of Tests, of the Chicago, Burlington & Quincy, has been selected to take the place of Engineer of Tests left vacant by the resignation of Mr. F. W. Sargent.

—Mr. William H. Starr, Superintendent of Transportation of the New York, Lake Erie & Western Railroad, was married Thursday, April 16, to Elizabeth, daughter of Mr. and Mrs. Richard Jordan, of New York City.

—Mr. G. R. Campbell, Roadmaster of the Toledo & Ohio Central, died at Bucyrus, O., April 17. Mr. Campbell became quite well known through his invention of the Campbell solid steel frog and of other track appliances.

—Mr. George S. Jones, formerly Secretary of the Lehigh & Wilkesbarre Coal Co., and Assistant to the President of the Central of New Jersey, has been chosen Vice-President of the North American Co., vice Mr. Colgate Hoyt, resigned.

—Mr. B. M. Cutton, formerly Division Superintendent of the Northern Pacific, has been appointed General Superintendent of the Western division of the Newport News & Mississippi Valley Co., to succeed Mr. J. L. Frazier, who has resigned.

—Mr. A. L. Dunbar, for many years Superintendent of the New York, Pennsylvania & Ohio at Meadville, Pa., has been appointed General Agent for the O'Neil Automatic Highway Crossing Signal Co., with office at No. 113 Public Square, Cleveland, O.

—Mr. Robert Barry, formerly Eastern Superintendent of Pullman's Palace Car Co., will represent the Railroad Lighting & Mfg. Co., which controls the Frost dry carbureter system of car lighting, as Third Vice President, after May 1. His headquarters will be at Atlanta, Ga.

—Capt. T. W. Whisnant, who has been Superintendent of the Carolina Central division of the Seaboard Air Line for the last year, has been appointed Superintendent of the Georgia, Carolina & Northern, to succeed Captain J. A. Dodson, who is now Division Superintendent of the Richmond & Danville.

—Mr. John Weekes, of Schenectady, N. Y., who died in that city last week, at the age of 94, was an engineer on the Utica & Schenetady road 50 years ago, and also served on the New York Central after the formation of that company. Three sons and two grandsons of Mr. Weekes are engineers.

—Mr. Edward Bates Dorsey, who for some time past has been in the Dutch South African States trying to arrange for building a railroad connecting them with the coast, and is now in London, will return to this country in time to read a paper before the American Society of Civil Engineers, at their Chattanooga meeting, on "Free Railroad Construction vs. Government Railroads."

—Mr. Charles T. Gainor, Freight Claim Agent of the Baltimore & Ohio, died at his home in Baltimore, April 19, after an illness of several months. Mr. Gainor was 46 years old. He entered the freight department of the Baltimore & Ohio as messenger. About seven years ago he was appointed to the position he held at the time of his death. He had been continuously in the employ of the freight department of the road for 21 years.

—Mr. John Houghtaling, conductor of the Lake Shore & Michigan Southern train which was wrecked by breaking in two and running together at Bay View, N. Y., March 6, 1890, and who was indicted for manslaughter, but was acquitted, died at Buffalo March 21 last. It is said that the collision and subsequent indictment of the conductor so preyed on his mind that he died of a broken heart.

—Mr. William G. Oakman, First Vice-President of the Richmond & Danville, has been appointed to a similar position on the Central of New Jersey. Mr. Oakman has been connected with the Richmond & Danville for many years. He was elected First Vice-President in January, 1890, to succeed Col. T. M. R. Talcott. Mr. Joseph S. Harris, whom Mr. Oakman succeeds as Vice-President of the Central of New Jersey, was formerly one of the receivers of the road and has been Vice-President since its reorganization. He has also been President of the Lehigh Coal and Navigation Co., and he will hereafter give his entire attention to the interests of that company.

—Mr. A. Von Borries, Superintendent of Motive Power of the Hanover Division of the Prussian State Railroads, and Mr. T. H. Buete, Superintendent of Motive Power, Madgeburg Division, arrived in New York on the 11th inst., and propose to spend about six weeks in the United States. They will make quite an extensive and careful inquiry into methods of railroad construction, maintenance and operation in the United States, visiting many shops and offices in various cities. Probably they will go as far West as Denver. The name of Mr. Von Borries is already very well and favorably known to American engineers, and Mr. Buete is also an officer of standing and distinction. No doubt they will receive at the hands of American railroad men the courtesies and attentions which their positions entitle them to.

—Mr. F. W. Sargent, who has been well known in railroad mechanical circles as Engineer of Tests of the Chicago, Burlington & Quincy, at Aurora, has resigned that office to accept a position as Mechanical Engineer of the Congdon Brake Shoe Co. at Chicago. Mr. Sargent's work on the Burlington is well known in connection with the Air Brake Committee of the M. C. B. Association and the train resistance tests and comparative locomotive tests made a few years since to show the relative value of the new class "H" mogul and other heavy engines on Western railroads. His recent labors on the relative values of different materials for brake shoes have not been published, but they are of great value and cover a large list of material. Mr. Sargent's work has been characterized by a conscientious fairness that has given confidence to all business firms with whom he has been brought in contact.

ELECTIONS AND APPOINTMENTS.

Boulder Terminal.—The following officers have been elected: E. J. Temple, President; J. M. O'Neill, Vice-President; J. G. Cope, Treasurer, and E. J. Morath, Secretary. The office is in Boulder, Colo.

Brakenridge.—The following directors were elected at a recent meeting of the Brakenridge Railway & Navigation Co., at New Orleans: E. A. Brakenridge, E. D. Saunders and C. E. Brakenridge. E. A. Brakenridge is President, E. D. Saunders is Vice-President, and C. E. Brakenridge is Secretary and Treasurer, and E. F. Brakenridge is General Manager.

Central Counties.—At a meeting of the directors last week Col. Higginson, of Vankleek Hill, Ont., was elected President; C. R. Cunningham, Ottawa, Vice-President, and R. W. Cowan, Secretary.

Chicago, Burlington & Quincy.—J. C. Swartz, General Agent of the Denver, has resigned his position and retired from the service of the road on April 20. He is succeeded by George Vallary, who is now General Agent of the company at Salt Lake City. Mr. Vallary will be succeeded at Salt Lake City by Frank Adams, who is Freight Agent of the company at Denver.

Chicago & West Michigan.—The annual meeting of the stockholders of the company was held in Muskegon, Mich., April 16. The following were elected directors: H. H. Hunnewell, G. O. Shattuck, F. H. Damon, Charles Merriam, C. F. Adams, Nathaniel Thayer, E. V. Thayer and H. H. Hardy, of Boston, and C. M. Heald, of Grand Rapids, Mich.

Greenbrier & Gauley River.—The following are the incorporators of the company: Alexander McVeigh Miller, Enoch Smith and William Proctor Smith, Alderson, W. Va.; T. H. Jarrett, Blue Sulphur Springs, W. Va.; and Henry Gilmer, Lewisburg, W. Va.

Gulf, Western Texas & Pacific.—At a meeting of the directors held in Victoria, Tex., April 13, the following officers were elected: President, J. Kruttschnitt; Vice-President, W. D. Monserratt, Treasurer; W. J. Craig, and Secretary C. S. Wells.

Hendersonville & Brevard.—C. E. Wilson, J. R. Zachary, J. L. Bell are the incorporators of the North Carolina company.

Kansas City, Memphis & Birmingham.—J. R. Horton has been appointed Division Roadmaster of the Birmingham division of the road, vice L. Barnett, resigned, and W. Townsley Division Roadmaster of the Memphis division, in place of M. M. Birdsong, who has been appointed supervisor of the Jackson division of the Illinois Central road.

Kansas City, Watkins & Gulf.—J. H. Lape, formerly Master Mechanic of the Texas & Pacific, has been appointed Master Mechanic of this road, with headquarters at Lake Charles, La.

Kennebec & Farmington.—The following were named as incorporators in the charter which recently passed the Maine Legislature: A. M. Spear, E. C. Allen, Weston Lewis, P. O. Vickery, W. M. Bradstreet, M. V. B. Chase, P. H. Holmnes, J. Manchester Haynes, J. S. Maxey, J. W. Lash, George E. Macomber, F. E. Timberlake, Joseph C. Holmon, Elliot Wood, H. L. Shaw and H. M. Heath.

Kentucky & Indiana Bridge Co.—John Newhouse has been appointed Master Mechanic of the company's shops at Louisville.

Long Island.—Everett R. Reynolds, formerly private secretary to President Corbin, has been appointed assistant to the President. He was elected a director at the recent annual meeting.

Montana & Wyoming Eastern.—The following officers have been elected: President, D. S. Wade, of Helena, Mont.; Secretary, W. E. Cox, of Helena, and Treasurer, Charles Baldwin. George Irvin is Chief Engineer.

Morristown & Cumberland Gap.—At a meeting of stockholders in Morristown, Tenn., last week, the following officers were elected: President, J. C. Fawcett, of Louisville, Ky.; Vice-President, T. H. McKoy, Jr., of New York City; Secretary and Treasurer, C. R. Johnson, and Chief Engineer, F. J. Mosier.

Nebraska Board of Railroad Secretaries.—The State Board of Transportation at a meeting in Lincoln, April 21, the following officers of this board were elected: P. A. Dilworth, of Adams County, J. W. Johnson, of Lancaster, and J. N. Koontz, of Hayes.

Newport News & Mississippi Vally Co.—The offices of L. B. Lewis, Jr., Auditor, and P. B. Gaynor, Cashier, of the company's Eastern Division, and of the Ohio & Big Sandy Railroad have been removed from Cincinnati to Lexington, Ky. The duties of those officers have been extended over the Kentucky & South Atlantic road.

Nolan County.—The company has been charted in Colorado with the following board of directors; B. Clark Wheeler, W. Porter Nelson, C. I. Glassbrook, A. H. Fulford and T. G. Lester. The incorporators are B. Clark Wheeler, Charles Drever, C. I. Glassbrook, W. Porter Nelson and L. S. Smith.

North Carolina.—Gen. R. F. Hoke, of Raleigh, N. C., was elected, April 15, to the Presidency of this company. James H. Holt, of Burlington, N. C., was elected to succeed Gov. Holt on the Board of Directors. Gen. Hoke has since declined the office.

Northern Central.—At a meeting of the directors of the company held last week in Philadelphia, Major Luther S. Bent and Henry D. Welsh were elected to fill vacancies caused by the death of Wistar Morris, of Philadelphia, and George Small, of Baltimore.

Northern Pacific.—H. H. Bedolve has been appointed Division Engineer of the western division of the road, with jurisdiction from Hope, Idaho, to Portland, Or.

Ohio Southern.—The annual meeting was held in Springfield, O., April 20, and the following-named officers were elected: President, Alfred Sully, New York; Vice-President and Treasurer, Henry Graves, New York; Secretary, Wilberforce Sully, of New York. The only changes made in the directory were the election of Gen. A. S. Bushnell, vice A. J. Beckley; Maurice Sternberger, vice Superintendent W. H. Van Tassell.

Oregon & California.—At the annual meeting of the company in Portland, April 14, the following directors were elected: C. P. Huntington, A. H. Pardee, Charles F. Crocker, W. V. Huntington, Timothy Hopkins, John McCraken, Donald Macleay, R. P. Earhart, R. Koehler, W. W. Bretherton and George H. Andrews.

Pacific Coast & Eastern.—C. W. Towe, L. C. Carrigus, C. F. Miller and H. A. Moss, have chartered this company in Oregon.

Quincy Electric Freight.—Among the incorporators of the company are John Quincy Adams, Henry L. Higginson, and Mr. Armstrong of Kidder, Peabody & Co.

St. Louis, Arkansas & Texas.—D. H. McCullough, General Agent at Houston, Tex., has been promoted to the position of Division Freight Agent of the same road, with headquarters at Little Rock, Ark.

Terminal Railroad Association of St. Louis.—At the annual meeting in St. Louis last week the following officers were elected: Dr. William Taussig, President; J. F. Barnard, Vice-President; James Hanna, Secretary and Assistant Treasurer; A. H. Calef, Treasurer.

Saratoga & St. Lawrence Extension.—The first board of directors is as follows: Ernest G. Reynolds, W. B. Babcock, and Thomas A. Sears, Bombay, N. Y.; Alfred A. Falton and Charles McConnell, Hogansburg, N. Y.; C. W. Breed, Frederick D. Kilburn, Orrin S. Lawrence, Nelson W. Porter, and Thomas Cantwell, Malone, N. Y.; Allen S. Mathews, Fort Covington, N. Y.; F. W. Baldwin, Ogdensburg, N. Y.; and E. C. Smith, St. Albans, Vt.

Seattle, Tacoma & Portland.—The incorporators of this Washington company are: F. H. Osgood, Herman Chapin, Josiah Collins, D. N. Baxter, R. C. Washburn, E. A. Strout and W. A. Peters.

Silver City & Northern.—At the annual meeting of the Board of Directors of the company, held in Silver City, N. Mex., the following officers were elected: C. Lawrence Perkins, President; R. P. Perkins, Secretary and Treasurer, 33 Wall Street, New York City, and T. G. Condon, Vice-President and General Manager, Whitewater, N. Mex.

South Bound.—At an election held in Savannah, Ga., recently, a board of directors was chosen as follows: B. A. Denmark, H. M. Comer, John Flannery, T. F. Stubbs, W. B. Stillwell, Herman Myers, J. H. Estill, and Samuel Meinhard, Savannah; J. H. Parker, New York; F. S. Hambleton, Baltimore; Charles Watkins, Richmond, Va.; A. C. Haskell, Columbia, S. C.; S. H. Hawkins, Americus, Ga. The following officers were re-elected: President, B. A. Denmark; Vice-President, Charles Watkins; Treasurer, Herman Myers; Secretary, Marmaduke Hamilton; Chief Engineer and Superintendent, G. D. Wadley.

Toledo, Ann Arbor & North Michigan.—The annual meeting was held in Toledo last week, and the following directors were re-elected: J. M. Ashley, A. W. Wright, Henry W. Ashley, W. R. Burt, Wm. Baker, David Robinson, Jr., S. Dean, T. W. Childs, J. M. Ashley, Jr., E. A. Todd, T. W. Whitney. The directors elected officers as follows: President, J. M. Ashley, Toledo; Vice-Presidents, J. M. Ashley, Jr., Toledo, and A. W. Wright, Alma, Mich.; General Manager, Henry W. Ashley, Toledo.

Unadilla Valley.—The following officers were elected at a meeting in New York last week: President, George H. Scott; Vice-President, Ralph Brandreth; Treasurer, Frederick F. Culver, and Secretary, R. Floyd Clarke, 80 Broadway, New York.

Valley (Ohio).—The annual meeting was held in Cleveland, O., last week. The old board of directors was re-elected. Thomas M. King was elected President; S. T. Everett, Vice-President; Henry M. Krim, Treasurer.

Washington City & Point Lookout.—The officers of this road are: President, Charles H. Green; Vice-President and General Manager, William J. Best, and Secretary and Treasurer, Herman Knubel. The office of the company is at 82 Church street, New York City.

Wheeling & Connellsville.—The incorporators are Robert H. Cochran, W. A. Lynch, F. J. Hearne, W. A. Isett, F. N. Vance, George Wise, A. J. Clarke, Cecil A. Robinson, John G. Hoffman, Henry K. List, Joseph Speidell, Anton Reymann, James B. Taney, Earl W. Oglebay, John Frew and William P. Hubbard, of Wheeling, W. Va.

RAILROAD CONSTRUCTION,
Incorporations, Surveys, Etc.

Andalusia.—The company has been chartered in Alabama by W. C. McCarnahan, A. B. O'Neal, J. A. Prestwood and others to build a road from Andalusia to Saginaw, on the Conecuh River. The capital stock is $50,000.

Bangor & Aroostook.—At an election held in Aroostook county, Me., April 20, the proposition to vote this company county bonds to the extent of $500,000 was carried with little opposition. The road is projected to extend from Bangor northwest to Presque Isle, a distance of 135 miles. It is expected now that these bonds have been voted that the balance of the funds needed to complete the road can be easily raised.

Bennettsville & Gibson Station.—The company was chartered by the last South Carolina legislature, and has organized with F. B. Gibson, President, and C. P. Townsend, Secretary, to build a road from Bennettsville to Gibson Station, S. C., a distance of nine miles.

Boulder Terminal.—The organization of the company was completed at Boulder, Col., April 15. George S. Oliver, the Chief Engineer, commenced the survey last week at Boulder, and will continue it east through Owens Lake and south to Denver, about 30 miles. It is stated that the location will be made during May, and that the right of way will be secured as soon as the route has been definitely decided upon.

Brakenridge.—The Brakenridge Railway & Navigation Co. was chartered in Louisiana recently with a capital stock of $500,000, to build a road through St. Helena county, north of New Orleans. The line will probably extend from Greensburg to Livingston and thence in a northwesterly direction to a point on the Tickpaw River. Branches will be built to Springfield and Blood River.

Canadian Pacific.—About 150 miles of road will be completed in Manitoba under the recent agreement with the provincial government, by which the company receives a cash subsidy of $150,000 for extension of its branches in Manitoba. The lines which are to be built include the extension of the Plum Creek branch from Hartney, Man., its present terminus, to the Souris coal fields, some distance beyond the western boundary of the province. The distance is 120 miles. The Deloraine branch is to be extended to Melita, Man., where a junction will be formed with the Plum Creek line, a distance of 25 miles. In addition to this the Glenboro branch is to be extended five miles. The surveys for these extensions have already been made, and grading has been commenced on some of the lines. The company agrees to deliver coal in Manitoba for $4 a ton, $3.50 less than present prices.

Cambria & Clearfield.—The contracts for building this road will belet in a few weeks. The company is now receiving bids for the grading on the line extending from a point on the Ebensburg & Cresson at Kaylors, Pa., via the valley of Chest Creek to Carrolltown; thence to Walnut Run and up Walnut Run to the summit at the head of Brubaker. The object of the construction of this line is to open up a new territory for bituminous coal. It is being built by the Pennsylvania and will be operated in connection with the Ebensburg & Cresson. This road has never earned the interest upon its bonds and the property is now being sold out on a judgement. This sale will take place May 8.

Central Counties.—The grading recently commenced at Glen Robertson is for the section between that point, where connection is made with the Canada Atlantic, and Hawksbury, Ont., a distance of 20 miles. Three other branches of the line are projected, but it is not expected that any further work will be undertaken this year. One branch will extend from Vankleek Hill to Caledonia Springs; another between Cornwall and Moose Creek, and a third betwen Rockland and Casselman, Ont. The length of these three lines will be 67 miles.

Chesapeake & Ohio.—Engineers have commenced a survey at the mouth of Cedar Creek, near Covington, Va., where the Warm Springs branch leaves Jackson River, which is to extend to the West Virginia state line and which will, when completed, establish a connection with the West Virginia & Pittsburgh.

Chicago.—The charter of this company, which was recently filed in Illinois, provides for the construction of a partly elevated and partly surface road from a point in Blue Island, Cook county, to a point in the business district of Chicago, near Lake street, with branches extending through the north, south and west divisions of the city of Chicago. James T. Young, M. M. Henneberry and others of Chicago, are the incorporators.

Covington Belt.—Arrangements have been completed, it is announced, for the building of a proposed belt road at Covington, Va., by the Covington Improvement Co. and the Chesapeake & Ohio, jointly.

Florida.—Bills have been introduced at the present session of the state legislature to incorporate the Arcadia, Gulf Coast & Lakeland; to extend the charter of the Palatka & Anclote, the Suwannee & Gulf, and the Blue Springs, Orange City & Atlantic; to grant to the Florida, Georgia & Western 10,000 acres of land for each mile of road constructed from Tallahassee to Gainesville, Fla; to continue the privileges, franchises and grants of the Carrabelle, Tallahassee & Georgia, formerly the Augusta, Tallahassee & Gulf, and previously the Thomasville, Tallahassee & Gulf, and to extend the time for its completion; to grant lands to the Western Railway of Florida; to aid in the construction of a line from the western terminus of the Green Cove Spring & Melrose road to Melrose, with branches to Starke and Hawthorn.

Fort Worth & Rio Grande.—The contract for the grading and tracklaying on the extension from Comanche southwest through Blanket and Brownwood, on the Gulf, Colorado & Santa Fe, a distance of about 30 miles, was let last week to Hurley, Tierney & Lynch, of Fort Worth, Tex. The same contractors also have the work on the stations and the yards. The terminus of the extension will be at stockyards about one mile south of Brownwood. The locating surveys have been made for the entire distance, and grading was commenced April 20. It is expected that the line will be completed in three months. There are two iron bridges to be built near Brownwood, one 100 ft. long and another 150 ft. long. The work is comparatively light, and the maximum grade will be one per cent. and the maximum curvature four degrees.

Grand Trunk.—McArthur Bros. & Co., of Chicago, the contractors for the double tracking of the line from Napanee to Gananoque, Ont., a distance of 43 miles, expect to resume work in a few weeks. Most of the grading and rock work was completed last fall. Besides this contract Sinclair & Doheny, of Toronto, have a contract to build the second track from Trenton, just west of Belleville, to Port Hope, and from Port Union to Scarboro, Ont., near Toronto, a distance altogether of 42 miles. Over 185 miles of the double track between Montreal and Toronto is now in operation, and with the completion of the 85 miles now under contract there will be only 62 miles between Montreal and Toronto on which the double track work has not been commenced. Between Toronto and Hamilton 5½ miles of the double track work is in operation and the track has been laid on 14 miles additional, which has also been partly ballasted.

Greenbrier & Gauley River.—The company filed a charter in West Virginia last week to build a road from a point near Alderson, W. Va., and thence along Muddy Creek, Meadow River, Big Clear Creek, Laurel Creek and Cherry River to the mouth of Cherry River, in Nicholas County.

Gulf & Ship Island.—Captain W. H. Hardy, the President of the road, recently closed a contract with the Toby Construction Co., of Chicago, to complete the road between Hattiesburg and Gulfport, Miss. It is understood that the grading will begin this summer.

Idaho Falls, Salmon River & Puget Sound.—The articles of incorporation of this company will be filed in Idaho this week. The company proposes to build a line from Idaho Falls north along Birch Creek, and down the Lemhi and Salmon rivers to Salmon City. A connection is to be made at that point with a line which is to extend to Lewiston.

Jacksonville, St. Augustine & Halifax River.—The right of way was recently secured by citizens of San Mateo, Fla., for a branch of the road south to that town. It is stated that the company has agreed to construct a line from a point east of East Palatka, south through San Mateo and connect with the main line again at Thigpen station.

Johnson City & Greensboro.—This company is one of the many chartered at the last session of the North Carolina legislature. It is to extend from Johnson City, Tenn., via the Cranberry Iron Mines, to Wilkesborough, S. C., on the Richmond & Danville.

Kansas City, Watkins & Gulf.—The Prosser Ware Construction Co., of St. Louis, which has the contract for completing the 27 miles of the road north to Alexandria, La., has had a considerable force engaged on the work for some weeks, and now reports it nearly completed. The chief engineer of the company has finished the surveys between Alexandria and Pineville. The line follows the Red River for some distance and crosses the Morgan's Louisiana & Texas road at Morgans.

Kentucky Union.—Twenty-five miles of the road in Breathitt county, Ky., is reported to have been damaged by depredations of unpaid employés and laborers who were engaged on the construction of the line through Breathitt county, the southerly portion of the road. The track was torn up, and bridge and culverts burned and destroyed. Judge Barr, of the United States District Court, granted an order at Louisville, Ky., this week, permitting J. Kennedy Tod, of New York, the receiver, to extend the road to Jackson, a distance of three miles, and to issue receiver's certificates to the amount of $125,000 to pay off debts to employés.

Lexington Belt.—The Lexington Development Co. is building a short road through its property at Lexington, Va., from the station of the Baltimore & Ohio and Chesapeake & Ohio to limestone quarries and iron ore properties about a mile distant. The road may be extended to form a complete belt line at Lexington, but at present no work will be undertaken on the extension beyond the quarries.

Louisville & Nashville.—The grading on the Clarksville Mineral branch has been recently resumed and the work is now being rapidly pushed. The engineers expect to have the road completed by July 1. Some disagreement between the sub-contractors has been recenty settled and the work will now be continued without interruption. The road will be about 31 miles long, extending from a point on the Memphis division of the Louisville & Nashville, about eight miles west of Clarksville, Tenn., south to a connection with the Nashville, Chattanooga & St. Louis, at Ponds station, two miles west of Dickson, Tenn. A branch will probably be built to the Cumberland furnace, six miles from the main line.

Montana, Wyoming & Eastern.—The Chief Engineer of the company is running a preliminary survey in the southern part of Montana. The preliminary surveys have been made for about 100 miles from Helena, southeast via Townsend and Sixteen-mile Creek, east to the Castle mines, and thence southeasterly to the Montana-Wyoming state line. The route has been definitely surveyed as far as Castle. No contracts have yet been let for the grading, and will not be before summer. George Irvin is Chief Engineer.

Montgomery, Tuskaloosa & Memphis.—The construction work north of the Alabama River which was partly suspended in January, has been very generally resumed all along the line. The grading is finished between Montgomery and Maplesville, Ala., and about half of the grading between Maplesville and Tuskaloosa, has been completed. All the line except about ten miles is now covered by grading forces, and it is believed that the road will be completed without further suspension or delay.

New Brunswick.—The provincial legislature has passed bills granting subsidies to the following railroad companies: $2,500 per mile for 23 miles of road from St. John to Barnesville, King's county; 28 miles of the Tobique Valley; 32 miles on the St. John Valley, below Fredericton; 35 miles of the Restigouche road toward the St. John river; 20 miles from Shediac to Shemongue, in Westmoreland; 20 miles in Northumberland, from Newcastle toward Tabuscintac; 14 miles from Buctouche to Kingston, Kent; a 14-mile branch of the Caraquet in Gloucester; a 12-mile branch of the St. Francis in Madawaska; 20 miles between Woodstock and Centreville, in Carleton county; also certain shorter branches, bringing the total mileage subsidized up to 250 miles.

New Roads.—The project to build a road from the sandstone quarries on the Potomac River at Seneca, Md., a few miles south of Darnestown, to Gaithersburg, on the Metropolitan branch of the Baltimore & Ohio, has been recently revived. The line is about 10 miles long. Nothing definite has yet been done, but a survey may be made this summer. The principal object in building the road is to give rail facilities to the quarries. The only means of transportation is over the Chesapeake & Ohio Canal to its terminus at Georgetown. The idea of the company owning the quarries is to construct a short line of road to intersect the Baltimore & Ohio, and enable them to reach Baltimore and Philadelphia without the expense of reloading the stone. Upton Darby, of Seneca, is interested.

Asher Gruver, of San Antonio, Tex., and S. J. Whitsell, of Pleasanton, Tex., are promoters of a project to build a road from San Antonio to Oakville, a distance of 80 miles.

A survey is being made by the Charlestown Mining & Mfg. Co. for a belt line north of Charlestown, W. Va., across its property, to connect the Baltimore & Ohio and the Shenandoah Valley roads.

New York & New England.—The directors are expected to decide next week whether the proposed branch from the main line at East Thompson, Conn., southeast to Pascoag, R. I., the northern terminus of the Providence & Springfield branch is advisable. The building of the Woonsocket & Pascoag may make the line unnecessary at present.

Nolan County.—The articles of incorporation of the company were filed at Aspen, Col., this week. The company is to extend a line from Rio Aguila, a station on the Denver & Rio Grande in Eagle county, up the valley of Brush Creek to its source, with a branch from the confluence of Nolan with Brush Creek. The capital stock is $2,000,000.

Norfolk & Western.—The last rail of the main line of the Clinch Valley division of this road was laid on April 13 at Norton, Va., under the immediate direction of Mr. Emile Low, engineer in charge of the division. On that day 7,000 ft. of track was laid. This completes the Clinch Valley division, which extends from Graham on the New River division to Norton, a distance of 100 miles. At the latter place a connection is made with the Louisville & Nashville, which is building between Cumberland Gap and Norton. That road expects to lay the track to Norton about May 1. The completion of these divisions will give a new trunk line from Louisville to Norfolk. The Norfolk & Western is now erecting a passenger and freight station at Coeburn, Va., situated in the center of a practically inexhaustible field of gas coal, which is being developed by the Virginia Gas Coal Co. The coal lands will be reached by the Little Tom branch, now under construction.

Northern Pacific.—The decision of the United States Attorney General, granting the company right of way through a small strip in the western portion of the Nez Perces Indian reservation in Idaho, will bring about the early completion of the road from below Kendrick to Lewiston, Idaho. Only about 15 miles of the road remains to be built, to complete the 72 miles of road between Pullman, Wash., and Lewiston. The original contract called for its completion last November, but the delay at Washington in granting the right of way across the reservation retarded the work considerably.

Pacific Coast & Eastern.—The charter of this company was filed in Oregon last week. The road proposed is from a point on the east side of Coos Bay across the coast range to the Umpqua River, and along it to Winchester, Douglas county. The office is to be at the west terminus, Millicoma.

Pennsylvania.—The reports that surveys were recently begun from Roxborough to Chestnut Hill for a new branch of the suburban lines at Philadelphia were unfounded. No such survey is in contemplation and the company does not think that the line proposed is needed for present traffic.

Philadelphia, Harrisburg & Pittsburgh.—The track laying was completed April 18, 29,000 ft. of track having been laid in the last week. Freight trains began running regularly on the new road between Harrisburg and Shippensburg, Pa., April 20. A large passenger station in Harrisburg will soon be completed. The new route is an extension of the Lebanon Valley branch of the Reading, which it leaves about half a mile east of the passenger station in Harrisburg, and passes through that city and over the tracks of the Pennsylvania by an elevated structure, and across the Susquehanna River on a new bridge just completed, but a few feet distant from the unfinished South Pennsylvania bridge. From the south side of the river about ten miles of new road has been built to Bowmansdale, in Cumberland county, where the old Harrisburg & Potomac Railroad is reached. This is one of the lines controlled by the Reading, but has never paid operating expenses. It has recently been rebuilt and put in good shape. This takes the Reading system to Shippensburg, where connection is made with the Western Maryland road, and by that line with the Baltimore & Ohio at Hagerstown, Md. It is building a short connecting line from Williamsport, Md., to Cherry Run, W. Va., which will effect a saving of a number of miles. The new line gives to Philadelphia some of the competition which the South Pennsylvania would have given if built.

Pittsburgh & Western.—A branch has just been completed to stone quarries at Windsor, O., and the line has been placed in operation.

Portland & Puget Sound.—The work is to be resumed on this line at once, after a suspension since Dec. 9. A settlement with J. H. Smith & Co., of Portland, Or., the sub-contractors under Kilpatrick Bros. & Co., was effected last week, and new contracts for the work were let. It is understood that the new contract has been let directly to J. H. Smith & Co. Mr. Smith, speaking of the present state of the work, says: The road is fully half completed. Work between Vancouver and Kalama is about seven-eighths completed. Between Kalama and Winlock over half is done. From Winlock for a distance of eight or nine miles there is but little done, and from a point about four miles south of Chehalis to Olympia the road is perhaps three-fourths completed. Between Olympia and Tacoma there is but little done, only about one-sixth. Nothing has yet been done between Portland and Vancouver, but the grade is easy, and the principal work will be the construction of a number of trestle bridges. If work is started up at once with the same force as in the fall the work will be completed this summer. I have every reason to believe that the Vancouver Bridge will be completed. The company has done so much work on it already that it would be too great a loss to abandon the project now."

Port Reading.—The contract for the superstructural work of the bridges on the new extension of the Philadelphia & Reading from Bound Brook, N. J., to the Arthur Kill, has been awarded. The difficulty concerning right of way through property of the Lehigh Valley Railroad has been adjusted and the work is now proceeding rapidly on the greater part of the line between Bound Brook and New York Bay.

Port Townsend Southern.—The 20 miles built last year from Port Townsend south to Lake Hooker, Wash., is being ballasted by a force of about 250 men. This work and the grading on the eight miles to Quilcene, at the north end of Hood's canal, is progressing toward completion very satisfactorily. The grading of the eight miles will be ready for tracklaying in a few days. J. H. Smith, of Portland, Or., is the contractor.

Regina & Southwestern.—This company is applying to the Dominion Parliament for incorporation to construct a line from Regina, N. W. T., in a southwesterly direction to the international boundary.

Roanoke & Southern.—The road was opened to Martinsville, Va., April 15. The terminus is sixty miles north of Madison, to which the trains have been running heretofore. Only a few miles of the track has been laid on the section this year. The contracts have been let on the balance of the line from Martinsville to Roanoke, and about 2,000 men are now at work on the grading of this 60 miles. The tracklaying will probably begin at Roanoke about May 15. The maximum grade on the section is about 80 ft. per mile and the maximum curvature 10 degrees.

Rockaway Valley.—The tracklaying has just been started on the extension from Peapack east to Mendham, N. J., a distance of six miles. All the grading was finished last year, but some of the trestles and other superstructure work were delayed until this spring.

Seattle, Tacoma & Portland.—The articles of incorporation of this company were filed in Washington this week. The capital stock is $500,000. The proposed road is to extend from Seattle to Tacoma and thence to the Columbia River—points which are at present connected by the Northern Pacific.

Silver City & Northern.—Five miles of the grading near Silver City, N. M., has been completed. The rails and other construction material are arriving daily, and it is expected that this first section of the line will be ready for operation by July 1. The contracts for the grading and tracklaying were let April 1, and the work has been progressing rapidly since that date. The surveys have been finished for the first 18 miles to connections with the Atchison, Topeka & Santa Fe and the Southern Pacific. The road is being built to give an outlet to large deposits of high-grade iron and other ores in Grant County in Southwestern New Mexico, which are owned in the East.

Sioux City Rapid Transit.—The elevated double track structure built by this company in Sioux City, Ia., was opened for traffic April 17, between Leech and Jones streets. The elevated portion of the line is about 1½ miles long, and it connects with a system of suburban surface tracks. The entire road is 4¾ miles long. The connection with the surface track is made at Leech street. The stations on the elevated portion are: Jones, Iowa, Steuben and Division streets; on the surface line, Leech street, Silberhorn, West Morning Side, Claverac, Larimer, St. Aubin, Peter's Park, Cheney's Villa, Clinton street, Lakeport Road, Hedges and East End.

Southern Pacific.—Early in 1890 a line was graded from Lacoste to Castroville, Tex., a distance of six miles, but was abandoned before the rails were laid. It is now said that this company will complete the branch, and extend it north along the Medina River to the Llano iron mines, a distance of 67 miles. A preliminary survey of the line has just been made. The grading will be very heavy, but there will be no large cuts.

Springfield, Sedalia, Marshall & Northern.—The preliminary survey from Sedalia, Mo., north, has been completed through Buffalo, to Urbana, in the northern part of Dallas county, a distance of about 45 miles. The directors have applied for a new charter in Missouri.

Sumpter Valley.—The company expects to commence laying the rails on the graded section of the line from Baker City, Or., by May 1. The contracts for the grading and tracklaying were let last fall, and the first 15 miles from that town were graded last year. The contractors have only recently resumed the work. The road is to extend from Baker City up the south fork of Powder River to Fort Sumpter, in Sumpter Valley, about 25 miles distant. The grading on the first 10 miles and the last five miles will belight, but on the intermediate section there will be a good deal of rock work which will be quite expensive. There will be 20 small bridges, and 15 of these are now in place. There is also one Howe truss bridge with a 100-ft. span. The average grade is 30 ft. and the maximum 75 ft. per mile. Joseph A. West, of Baker City, is Chief Engineer.

Syracuse & South Bay.—It is said that the franchise for the proposed road from Syracuse, N. Y., north to South Bay, on Oneida Lake, has been purchased by a New York capitalist, who will begin the work of construction soon. The amount required to build the road is about $250,000. The road is to be 13 miles long and was surveyed last year by Walter F. Randall, of Oneida, N. Y. J. H. Porter, 99 Nassau street, New York City, is President.

Washington City & Point Lookout.—The line south of Mechanicsville, Md., has been graded for 45 miles to near Point Lookout. Fourteen miles near the southern terminus is still uncompleted, but the company is grading the section. The tracklaying between Mechanicsville and Point Lookout will probably be completed this year. This division extends southeasterly through the peninsula formed by the Potomac and the Patuxent River to Point Lookout, on Chesapeake Bay. Trains are now running from Mechanicsville to Brandywine, 20 miles, and to Washington, D. C., connecting with the Baltimore & Potomac at Brandywine.

West Virginia Central & Pittsburgh.—A party of engineers has started from Cumberland to run a line for the extension of the road from Sinclairville, W. Va., to Hagerstown, Md., crossing en route the Potomac river, the Chesapeake & Ohio Canal and the Baltimore & Ohio road.

Wheeling & Connesville.—The organization of the company which proposes to build a competing line from Wheeling east to the Connelsville coke fields, near Pittsburgh was completed at Wheeling, W. Va., last week. The charter for the road will probably be filed this week.

Wheeling & Lake Erie.—The company does not intend to double-track its road between Norwalk and Toledo, as recently reported. The rumor probably arose from the fact that the company is at present engaged in double-tracking the Toledo Belt, in Toledo, which is the property of the Wheeling & Lake Erie.

Whidby Island.—It is proposed to build a road from Chicago, on the south end of Whidby Island, north to Sedro, Wash. The route will be over Whidby Island some 25 miles, across Saratoga passage, where a drawbridge will be built, and to La Conner and Sedro. The length of the road will be 50 or 60 miles. The route has been surveyed. A company has offered to undertake the work if a subsidy of $150,000 can be raised. Among those interested in the enterprise are John J. Phinney, of Whidby Island; Dr. G. W. Calhoun, of La Conner, and Capt. G. W. Morse, of Oak Harbor, Wash.

GENERAL RAILROAD NEWS.

Atchison, Topeka & Santa Fe.—The gross earnings, operating expenses (exclusive of taxes and rentals) and net earnings of the road and its auxiliary lines for the month of February were as follows:

	Gross earnings.	Operating expenses.	Net earn's.	Operated mileage.
Roads owned and controlled	$2,116,380	$1,579,979	$536,401	6,527
Roads jointly owned with other companies, Atchison Company's one-half	100,749	117,606	D. 16,858	587
Total—Atchison system	$2,217,129	$1,697,585	$519,543	7,114
St. Louis & San Francisco:				
Roads owned and controlled	$471,278	$271,538	$199,740	1,329
Roads jointly owned with Atchison, 'Frisco Company's one-half	97,834	114,140	D. 16,306	536
Total—'Frisco system	$569,112	$385,678	$183,434	1,865
Aggregate—both systems	$2,786,241	$2,083,263	$702,977	8,977

The following is the comparative statement of all lines:

			Per mile.		
Atchison system:	Gross earn.	Net earn.	Gross earn.	Net earn.	Mileage.
February, 1891..	$2,217,129	$519,543	311.64	$73.03	7,114
February, 1890..	2,221,312	648,410	312.41	91.19	7,110
Inc. or dec.....	D. $4,183	D.$128,866	D. .77	D.$18.16	I. 4
'Frisco system:					
February, 1891..	$569,111	$183,434	$305.12	$98.35	1,865
February, 1890..	603,668	236,755	325.36	127.60	1,855
Inc. or dec.....	D.$34,556	D.$53,321	D.$20.24	D.$29.25	I. 10
Aggregated general system:					
February, 1891..	$2,786.241	$702,977	$310.28	$78.29	8,980
February, 1890..	2,824,981	885,166	315.09	98.73	8,965
Inc. or dec.....	D.$38,740	D.$182.188	D.$4.81	D.$20.44	I. 15

Baltimore & Eastern Shore.—Capt. Willard Thomson, Superintendent of the Harlan & Hollingsworth Co., of Wilmington, Del., has been appointed Receiver of the road. It is admittedly insolvent, and has a mortgage indebtedness of $1,600,000 and a floating indebtedness of $60,000.

Bellingham Bay & British Columbia.—A special meeting will be held in San Francisco, Cal., May 4, to consider a proposed mortgage which is to be issued to secure $600,000 of new bonds.

Canadian Pacific.—A special meeting of the stockholders will be held in Montreal, May 13, the date of the annual meeting. The stockholders will be asked to accept the legislation by the Parliament of Canada authorizing the issue of consolidated debenture stock, and to vote on matters relating to the company's Souris Branch, the Columbia & Kootenay, the Lake Temiscamingue Colonization, the Calgary & Edmonton and a road from Saskatoon to the North Saskatchewan River; and of outstanding obligations in connection with the Manitoba Southwestern Colonization road.

Chicago & Grand Trunk.—The annual report of the company for the year 1890 shows gross earnings of $3,753,488, an increase of $120,164; operating expenses were $2,858,090, an increase of $136,354; net earnings were $895,399, a decrease of $15,189. The expenses for betterments during the year were $458,760.

Chicago & Northwestern.—The gross earnings for March exceeded those of 1890 by $118,761, or 6¼ per cent. and 1889 by $135,634, or over 7 per cent. and were the largest for any March since 1887, when the total was $2,334,782. The total gross for the three months ending March 31 show an increase of $106,181, or nearly two per cent. over the corresponding quarter of last year, and $562,793, or 11 per cent. over 1889. The following is a comparison of gross for the first three months of the year:

	1891.	1890.	1889.
January	$1,893,407	$1,855,767	$1,613,245
February	1,707,841	1,758,062	1,560,879
March	2,029,078	1,910,316	1,893,414
Three months	$5,630,326	$5,524,145	$5,067,533

Chicago, Rock Island & Pacific.—The annual report for 1890 shows: Gross earnings, $17,869,842; expenses, $11,934,446; net earnings, $5,935,376; other income, $1,348,048; total net, $7,283,425; charges, $5,464,178; balance, $1,819,247; dividend, 4 per cent., $1,846,231, and deficit, $26,984. The passenger rate per mile was 2.15 cents and the freight 1.22 cents. The gross floating debt is $874,542, and the net floating debt has increased during the year $414,787. The floating debt of the Western lines and accrued interest, rentals and dividends are not included.

Cincinnati & Southeastern.—This road, 17 miles long, extending from Johnson Station, on the Maysville & Lexington road, to Flemingsburg, Ky., was sold at Louisville, Ky., April 15, for $55,100 to McHarg & Co., of the Columbus (O.) Steel Co.

Kansas City & Southern.—The road was sold at Kansas City, April 21, for $250,000 to John I. Blair, to satisfy a deed of trust given to the Farmers' Loan & Trust Co., of New York, on Jan. 1, 1883, to secure its bonds. The road is 111 miles long, extending from Kansas City

to Osceola, in St. Clair County. The only bidder was John I. Blair, who owns the road and who authorized the sale to perfect his title to the road.

Manhattan (Elevated).—A meeting of the stockholders has been called for May 27, to increase the capital stock of that company $4,000,000. This new stock is to be used in acquiring the railroad and other property of the Suburban Rapid Transit Co., which was recently leased. The stockholders will vote on the ratification of the lease and the proposed agreement for exchange of the stock of the Manhattan for stock of the Suburban Rapid Transit.

Missouri, Kansas & Texas.—The Enabling act recently passed by the Legislature of Texas in favor of the company was approved by the Governor last week. The act authorizes the reorganization of several railroad corporations in that state into one new corporation, and will relieve the company of some harassing litigation. The old laws of Texas forbade the joint ownership or operation of competing lines, and was construed by the Texas Supreme Court to apply to all roads traversing the state. In August, 1870, a special act was passed authorizing the Missouri, Kansas & Texas to extend its own lines and to purchase or lease with connecting roads. In accordance with these privileges the International & Great Northern and the Galveston, Houston & Henderson were leased. In later years these privileges were revoked. Much litigation followed, as a result of which the International & Great Northern went into the hands of a receiver, and the charter of the East Line & Red River road was forfeited, and a state court receiver appointed. Under the act just passed and approved the new corporation will take title to all thecompany's property, including the lines in litigation.

The report of the receivers gives the gross earnings from Nov. 1, 1888, to Dec 31, 1890, as $18.175,571; operating expenses and taxes, interest on bonds and land expenses, $14,121,006; net earnings, $4,054,475; additional expenses for betterments and new equipment and construction, $3,342,932. Net surplus, Dec. 31, 1890, $711,542. The gross earnings increased $1,081,561, and net earnings increased $974,705, or 52 per cent. Interest has been paid on underlying bonds amounting to $326,000.

Ottawa & Parry Sound.—This company is applying to parliament for an act ratifying the agreement of amalgamation between the company and the Ottawa, Arnprior & Renfrew, or the Parry Sound Colonization, and authorizing the company to purchase the franchises of both companies.

Pennsylvania.—The General Manager's report, issued this week, gives the following statistics: During the year 20,066,268 passengers were carried between Philadelphia and Pittsburgh, an increase over 1889 of 2,266,861, or 12.74 per cent. The average distance traveled by each passenger in 1890 was 18.65 miles, against 19.18 in 1889. Between the same points there were moved 37,907,319 tons of freight, an increase of 5,499,121, or 16.97 per cent. The through oil shipments eastward aggregated 3,891,201, a decrease of 403,837. The coal and coke shipments combined amounted to 20,158,877 tons, an increase of 2,988,035 tons, or 17.4 per cent. The coke shipments alone increased 16 per cent., and the coal shipments increased 18 per cent. over those of 1889. Over the united roads of New Jersey 21,305,187 passengers were carried, an increase of 1,099,212. Of freight 14,953,268 tons were carried, an increase of 1,251.385, or 9.13 per cent. Over the Philadelphia and Erie division there was carried in 1889, 2,438,927 passengers, an increase of 254,416, and 13,788,143 tons of freight, an increase of 1,524,735 tons.

Philadelphia & Reading Terminal.—At the special meeting of the stockholders held in Philadelphia April 21, it was agreed to increase the capital stock from $300,000, the amount paid in of the original authorization of $3,500,000 to $8,500,000. This stock will be held by the Philadelphia & Reading and none of it will be placed on the market. The company will issue $8,500,000 of bonds, which will be sold to provide funds for carrying on the terminal improvements.

Providence & Springfield.—At a special meeting held in Providence, R. I., April 20, the stockholders voted to accept the several amendments to the charter not heretofore formally accepted by the stockholders, and authorized the directors to execute a mortgage of all the property to secure its bonds to an amount not exceeding $1,000,000, to be used in accordance with the provisions of the amendments to the charter passed a few weeks ago by the General Assembly of Rhode Island. The bonds will be guaranteed by the New York & New England, which operates the road, and by the city of Providence.

Richmond & West Point Terminal.—Respecting the report that more Richmond Terminal five per cent. bonds were to be issued, President Inman says: "There are to be no more bonds issued at present. There have been no more issued than the amount stated in the annual report, about $11,000,000. There will be more issued to take up the six per cent. bonds, but that is a good ways off. The process of amalgamating the properties into one is gradually going on. Within a few weeks, I think we will have completed the leave of the Georgia Central, guaranteeing seven per cent on the stock. The Terminal Company owns about five-eighths of the stock. This places about 6,200 miles under one management. We hope to lease East Tennessee in the same way later on. This will simplify traffic matters very much and enable us to retiremany expensive men."

Rome & Clinton.—In the County Clerk's Office at Rome, N. Y., there was filed last week a lease of this road to the Delaware & Hudson Canal Co. The lease was dated Jan. 1, 1891. The lessee is to maintain the organization of the railroad company, and is to pay an annual dividend at the rate of 6½ per cent. per annum upon the capital stock of the company, not exceeding $350,000.

St. Louis, Keokuk & Northwestern.—About May 1 the Hannibal & St. Joseph and the Kansas City, St. Joseph & Council Bluffs roads will be consolidated with the St. Louis, Keokuk & Northwestern and the Chicago, Burlington & Kansas City. The number of miles embraced in the consolidation is 1,085. The roads are proprietary lines of the Chicago, Burlington & Quincy.

St. Louis Southwestern—The Receiver's report will be issued shortly. The gross earnings for 1890 were $4,102,142, an increase over the previous year of $225,000. The high water caused extraordinary expenditures during the year of $71,391, besides losses from the stoppage of business. The Vice-President of the road states that "earnings of $550 per mile will pay fixed charges, and with gross earnings of $4,000,000 it would seem that much more than $800,000, necessary to pay the fixed charges, would be earned, which surplus will go toward interest on the schools."

Union Pacific.—The earnings for February show increases much smaller than the January figures, which gave an increase of $546,089 in gross earnings and of $607,496 in net earnings. The comparative statement for February is as follows:

WHOLE SYSTEM.

February.	1891.	1890.	Inc. or Dec.	
Gross earn	$2,779,023	$2,729,521	I.	$49,502
Oper. expen	2,075,514	2,075,664	D.	150
Surplus	$703,509	$653,857	I.	$49,652
Jan. 1 to Feb. 28.				
Gross earn	$5,894,400	$5,298,8?9	I.	$595,591
Oper. expen	4,207,383	4,268,940	D.	61.557
Surplus	$1,687,018	$1,029,869	I.	$657,149

The earnings of several of the principal branches show as follows:

February.	Gross.	Net	Inc. or Dec.	
Oregon Short Line	$544,641	$189,693	I.	$117,236
Oregon Navigation	347,299	73,760	I.	90,237
St. Joseph & Grand Island	52,808	6,652	D.	28,982
Since Jan. 1.				
Oregon Short Line	1,177,304	483.025	I.	409.669
Oregon Navigation	821.157	229,950	I.	347,085
St. Joseph & Grand Island	102,650	10,978	D.	79,381

Wheeling & Lake Erie.—The stockholders authorized an increase of the capital stock from $3,600,000 to $4,500,000 at a meeting held in Toledo, O., April 15.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, April 22, 1891.

There is no change in the situation as regards the refusal of the Alton to conform to the orders of the Board of Rulings. The Alton people claim that they are secure in their position, and intimate that some of the Eastern lines are with them, in spirit, at least, which gives them confidence of ultimate victory. They have as yet taken no steps looking toward the placing of their business in the hands of scalpers, as has been rumored. Should they do this, it will result in their being disciplined in the Western Passenger Association for a violation of the agreement of that association, and may result in considerable trouble with the Western lines. It is not likely they will adopt this extreme measure until they are forced to do so by reason of a serious falling off in their business. If they can hold up their business without doing so, they will be disposed to preserve their membership in the association. The Board of Rulings held a session here April 18, and invited representatives of the Western lines to attend. The situation was talked over, and the members of the Board explained some matters in connection with their ruling which the lines wished to know about.

The regular monthly meeting of the Western Freight Association was held this week, but nothing of consequence was done as every one thought it best to wait till after the New York meeting of May 6. Among the topics of more than local interest on the docket are: Rules governing the passage of men in charge of live stock; stopping stock in transit to finish loading without extra charge; export rates from Missouri River points; through westbound tariffs from points east of the Illinois-Indiana State line to Missouri River and points West; rates on pig iron to Missouri River points; freight carried in passenger trains; return passes to men in charge of one car of cattle or hogs; soft coal rates from Chicago and Mississippi River points to points west of the Missouri River; cast-iron pipe from southeastern furnaces to Missouri River points; rail and lake rates to Buffalo, etc.; grain rates Missouri River points to St. Paul; proposition to appoint inspectors at Missouri River points to supervise the billing of grain; divisions of through rates on grain from points on the Great Northern, Northern Pacific, and "Soo" lines to Chicago; proposition to establish half rates between points in Iowa on grain used for seed.

A conference between the representatives of the Chicago-St. Paul lines and the Commissioners of the Trunk line and Central Traffic Association was held last week to consider the matter of the routing of the west bound emigrant business, concerning which there has been considerable complaint on the part of the Western lines.

The Federal grand jury, which has been in session here since April 7, finished its work Monday and was discharged. Among other matters investigated were certain alleged violations of the Interstate Commerce law by certain railroads. The violations alleged are understood to have been by the Wabash, the Lackawanna Fast Freight Line, the Chicago, Milwaukee & St. Paul, and Swift & Co. Among the witnesses were several employés of Swift & Co. On being asked if they knew whether Swift & Co., or any employé of theirs, other than themselves, had obtained or procured for Swift & Co. the transportation of property by rail over any line of transportation or railroad subject to the Interstate Commerce law, within the past year and a half, at less than the tariff rate, they one and all refused to answer, on the ground that by so doing they might criminate themselves. On persisting in their refusal to answer they were ordered by the court to appear on May 4 and show cause why they should not be attached for contempt of court.

It will be remembered that the same question arose in the Counselman case, at which time Judge Gresham ruled that the witnesses were compelled to answer questions put to them by the grand jury. That case was appealed to the Supreme Court on that point, and decision has not yet been handed down. In speaking of the matter, U. S. District Attorney Milchrist said:

The Western Passenger Association, about 10 days ago, notified the New York, Chicago & St. Louis that if it did not stop selling unlimited tickets to St. Louis the roads in the association would retaliate by boycotting it. The Chicago & Alton, on hearing this, at once notified Mr. Finley that, being wholly opposed to boycotts, on every consideration, the company would not sanction the threats made against the eastern road.

At the meeting of the Western Passenger Association yesterday the Atchison moved that Chicago-St. Louis passenger rates be advanced to the old figure of $7.50, the Jacksonville Southwestern complication having been entirely fixed up. But Mr. Charlton of the Alton again stirred up a row by announcing that there was such a strong probability of his being obliged to reduce fares, to punish the eastern roads for boycotting the Alton, that he would not consent to advance St. Louis rates.

The Atchison, Topeka & Santa Fé has a dozen new dining cars ready for service and they will probably be put on when the new time table goes into effect, May 3. It is said that dining cars will soon be run through to the Pacific Coast.

"The investigation will by no means be abandoned. We have received orders from the department at Washington to get at the bottom of the facts in the case."

The Trans-Missouri Passenger Association has declined to authorize the issuing of 5,000-mile mileage tickets good over all the association lines.

Chairman Midgley of the Western Freight Association has given notice that May 1 is the date fixed upon for the advance in rates between Chicago and points in Minnesota and Dakota.

The Freight Committee of the Central Traffic Association has decided that all companies desiring to do so may issue return passes for men in charge of locomotives.

A call has been sent out for the adjourned meeting of the Advisory Board of the Western Traffic Association to be held in New York, May 6.

Traffic Notes.

The Boston & Albany, in withdrawing Chicago & Alton tickets from sale, states that the action is taken solely because it is made necessary by the position of its western connections.

The Interstate Commerce Commission is to hold a hearing in Spokane, Wash., May 15, to hear long-standing complaints against the Northern Pacific in the matter of freight rates.

Officers of the Richmond & Danville state that arrangements have been so far completed that within ten days through passenger trains will run from Jersey City over the Pennsylvania and the Richmond & Danville, to Atlanta, Birmingham and New Orleans.

The outlook for a large peach crop in Delaware is very encouraging. The peach buds have lived through the uncertain weather of March and are now so hardy that the growers are sure of a big crop. The Pennsylvania road is preparing for a big crop, not of peaches only, but of berries also. It is understood that 1,600 cars will be provided.

The Trunk Line and Central Traffic Board of Rulings has established a new schedule of differential passenger rates from Indianapolis and from Cincinnati to New York and Philadelphia and other Eastern points. The first class limited rate from Indianapolis to New York by the best routes is $19, and by roundabout routes and poorer lines $17.

The Georgia Railroad Commissioners, complying with a recent law, have investigated interstate tariffs and find that freight rates from Ohio River points to Atlanta, over the Western & Atlantic, are lower than from the Ohio River to other stations, short of Atlanta; and have called upon the road to explain matters. It is said that similar irregularities have been found in the tariffs of other roads and that the officers of the Central, the East Tennessee, the Georgia and other roads have also been notified to appear before the commissioners.

There has been some little friction at the Immigration Bureau in New York City, in consequence of passengers arriving from Europe with orders for tickets over the Chicago & Alton, who were unable to get the tickets on account of the refusal of the Trunk lines to furnish tickets over that road. Immigrants get their tickets from a joint office, but the superintendent of the Bureau says that if passengers experience any inconvenience or delay the Chicago & Alton may send an independent agent to look after its business.

The Interstate Commerce Commission, in an opinion by Commissioner Veazey, has decided the case of John P. Squire & Co. against the Michigan Central, the New York Central & Hudson River and the Boston & Albany, involving the rates on live hogs, live cattle and meat products, in favor of the complainants. The points decided are briefly as follows: Rates for the transportation of property should be based upon existing fixed facts and permanently continuing conditions, among which are bulk, weight and general value of the commodity, and expense of carriage; but purely commercial considerations, as cost of rents and labor, rates of taxation, fluctuating market prices, are neither legitimate factors nor fixed and stable conditions. Violation by one carrier of principles laid down in this case as governing relative rates on competitive articles does not justify similar violations by its competitors. The rates involved in this case are those on live hogs, live cattle and the dressed products of each. These are found to be competitive commodities and therefore entitled to relatively reasonable rates for transportation proportioned to each other according to the respective costs of service.

Reduced All-Rail Rates via Sault Ste. Marie.

It is announced in Chicago that the Canadian Pacific has issued a tariff reducing freight rates from New York to St. Paul and Minneapolis to: First class, $1.09, reduced from $1.20; second class, 91 cents, reduced from $1.03; third class, 73 cents, reduced from 81; fourth class, 49, reduced from 54; fifth class, 40, reduced from 45; sixth class, 35, reduced from 39. The tariff becomes effective April 23. It was understood that the Canadian Pacific had agreed to the $1.20 scale from New York to St. Paul, against $1.30 by way of Chicago, as made up in New York March 19. The other roads had all issued their tariffs on the agreed basis, which went into effect April 15. The rates now announced are lower than the agreed lake and rail rates by way of Chicago, which are on the basis of $1.11 New York to St. Paul.

East-Bound Shipments.

The shipments of east-bound freight from Chicago by all the lines for the week ending Saturday, April 18, amounted to 60,813 tons, against 62,464 tons during the preceding week, a decrease of 1,651 tons. The proportions carried by each road were:

	Wk. to April 18		Wk. to April 11	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	9,917	16.3	8,900	6.9
Wabash	3,885	6.4	4,284	14.3
Lake Shore	8,184	13.4	8,074	12.9
Ft. Wayne	5,453	9.0	5.757	9.2
Panhandle	6,869	11.2	6,671	10.5
Baltimore & Ohio	3,872	6.4	3,833	6.2
Chicago & Grand Trunk	7,361	12.1	10,381	16.6
Nickel Plate	6,869	11.3	7,538	12.1
Chicago & Erie	8,476	13.9	7,026	11.3
Totals	60,813	100.0	62,464	100.0

Of the above shipments 3,276 tons were flour, 30,293 tons grain, 5,269 tons cured meats, 1,714 tons lard, 7,382 tons dressed beef, 977 tons butter, 845 tons hides, 534 tons wool and 6,408 tons lumber. The three Vanderbilt lines together carried 41.0 per cent., while the two Pennsylvania lines carried but 20.2 per cent.